Expanding Renewables in Times of Crisis and Fiscal Constraint

On European Renewable Energy Transitions during the Economic Crisis and Austerity

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Abstract

Energy is the fundamental fuel for economic growth, yet it is also the largest emitter of greenhouse gases and a crucial driver of climate change. The promotion of clean and renewable energy sources hence stands at the core of contemporary sustainability transitions. However, such transitions depend on a supportive regulatory framework and require significant electricity grid expansions. They are consequently considered costly, burdening both governments and consumers. Nevertheless, the Europe 2020 Strategy that was introduced in 2010 as an answer to the global financial and economic crisis provided comprehensive targets for the expansion of renewables and the reduction of emission levels. However, as the EU was hit by the European Debt Crisis, member-states faced potentially contradictory policy objectives of reducing government debt levels under a policy of austerity, while rekindling economic growth and driving the expansion of renewable energy. This thesis, seeks to determine the role of the economic crisis and austerity for European renewable energy transitions. It does so through a nested-n approach that entails a comparative analysis, followed by in-depth case studies. As climate action is highly time sensitive, the thesis provides an important, topical contribution to our understanding of the under-researched relationship between the economic crisis and austerity with renewable energy and climate policy. Through its multi-level analytical approach, it identifies the complex interplay of economic, political and societal factors surrounding renewable energy transitions. The thesis highlights the overall importance of the 2020 targets in preventing a greater negative effect of the economic and financial hardship on renewables in Europe. At the same time, the analysis stresses the shortcomings of the current structure of the European energy market, and the economic and societal dangers stemming from the significant costs of the current regulatory approach.

Contents

List of Abbreviations

BGN	-	Bulgarian Lev (currency)
CMEC	-	Capacity System Mechanism
CO_2	-	Carbon Dioxide
CVM	-	Cooperation and Verification Mechanism
EAD	-	Bulgarian Energy Holding
EC	-	European Commission
ECB	-	European Central Bank
EMU	-	Economic and Monetary Union
ERSA	-	Energy From Renewable Sources Act (Bulgaria)
EU	-	European Union
EU-28	-	Referring to the 28 member-states of the EU
EUR	-	Euro (currency)
FiT	-	Feed-in Tariff
fsQCA	-	Fuzzy-Set Qualitative Comparative Analysis
GBP	-	Great Britain Pound Sterling (currency)
GDP	-	Gross Domestic Product
GHA	-	Global Hectare
GHG	-	Greenhouse Gas
GW	-	Gigawatt
HI	-	Historical Institutionalism
IMF	-	International Monetary Fund
IPA	-	Index of Policy Activity
LM	-	Liberalised Market System
MIBEL	-	Iberian Electricity Market
MNA	-	Medium-n Analysis
MoU	-	Memorandum of Understanding
MW	-	Megawatt
MWh	-	Megawatthours
NEC	-	National Electric Company (Bulgaria)
OECD	-	Organisation for Economic Cooperation and Development
PPA	-	Power Purchase Agreement
PV	-	Photovoltaics
QCA	-	Qualitative Comparative Analysis
R&D	-	Research and Development
RE	-	Renewable Energy
RES	-	Renewable Energy Source(s)
RET(s)	-	Renewable Energy Transition(s)
RPS	-	Renewable Portfolio Standard
SEP	-	Public Service System
SNA	-	Small-n Analysis
USD	-	US Dollar (currency)
VRE	-	Variable Renewable Energy Sources

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Declaration

I declare that this thesis is a presentation of my own work, other than where I have clearly indicated that it is the work of others. This thesis, or any part of it, has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

As this thesis is comprised of four academic papers, copyrights are in the process, or have been, transferred to the respective publishers. My Supervisors, Professor Charlotte Burns and Dr Julia Touza, have been acknowledged as co-authors in the journal publications. All data analyses and writing of this thesis is my own work.

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Chapter 1: Expanding Renewables in Times of Crisis and Fiscal Constraint

1.1 Introduction

The analysis of this thesis is set at a time of three concurrent crises; the global financial and economic crisis (GFEC), the European Debt Crisis, and the environmental crisis. Since 2007, each respective crisis has exerted its own pressures on European governments to rekindle growth, reduce debt, and promote environmental sustainability. The primary purpose of this work is, therefore, to determine how renewable energy transitions fared while the implications of the economic recession and debt-reducing measures under the auspices of austerity took a firm grip on European politics. Renewables stand at the centre of sustainability programmes, such as the Europe 2020 Strategy, which was enacted in 2010 in the wake of the economic crisis to mitigate climate change and transform Europe's economy. Yet, the economic and debt crises increasingly shifted the focus towards growing economic difficulties and raised concerns over the costs of climate action (Slominski, 2016; Skovgaard, 2014). This thesis seeks to determine whether the emerging political and economic dynamics affected the expansion of renewables as part of the 2020 Strategy.

Energy plays a crucial role in societal and economic development (Smil, 2004, 2010). However, from an environmental perspective it is a significant source of pollution (Heede, 2013). Indeed, while energy is "[a]mong the many human activities that produce greenhouse gases, [… it is] by far the largest source of emissions" (International Energy Agency, 2014, 7). Greenhouse gas (GHG) emissions stand at the centre of the contemporary environmental crisis (Intergovernmental Panel on Climate Change, 2014). As stock pollutants, they affect global ecosystems at an uncertain time in the future, requiring timely and effective action to prevent disastrous effects for mankind (Taylor, 2009; Lieb, 2004; Intergovernmental Panel on Climate Change, 2014). Transforming energy systems, hence plays a fundamental part in contemporary sustainability transitions, such as the Europe 2020 Strategy that seeks to increase the share of renewable energy in final energy consumption to an average 20% across the EU-28 by 2020, while at the same time reduce emission levels by an average 20% compared to 1990-levels.

However, while Europe has put itself at the forefront of a shift towards more sustainable economic growth through the 2020 targets, the EU was hit hard by the effects of the 2008 GFEC that brought to light the weaknesses of the architecture of the Economic and Monetary Union (EMU) (Busch *et al.*, 2013). The inability of several Eurozone member states (Greece, Ireland, Portugal and Spain) to repay or refinance their governmental debt without international help resulted in the so-called European Debt Crisis (Stracca, 2013; Edmonds *et al.*, 2010). Based on the Stability and Growth Pact, the Euro system is built upon an economic policy philosophy focused on balanced state finances with set governmental deficit (3% of GDP) and government debt targets in proportion to GDP (60% of GDP) (Ngai, 2012; Busch *et al.*, 2013; European Commission, 2015; Schuknecht *et al.*, 2011). The Eurozone hence introduced far-reaching austerity measures from 2010 onwards (McKee *et al.*, 2012; Edmonds *et al.*, 2010). Meaning 'discipline' or 'deprivation', austerity represents a government that is withdrawing from an expansionary fiscal policy and focuses on the consolidation of its finances through the management of increasingly (largely self-imposed) scarce financial resources, that imply the replacement of discretionary expenditures with pre-determined and constrained spending (Fitoussi and Phelps, 1986; Pierson, 2001; Zohlnhöfer and Zohlnhöfer, 2001).

There is an ongoing debate over the underlying assumptions of the importance of government debt for economic growth that inter alia surrounds the identification of the threshold between a 'sustainable' and a harmful debt level. The identification of this threshold remains elusive, even though a paper by Reinhart & Rogoff (2010) claimed that once public debt levels went above 90% of GDP, this would cause GDP growth to halve. The paper gained wide-spread attention in the aftermath of the GFEC and was used as evidence in support of strict austerity policies for countries with respective debt levels by inter alia the EU Commission and the UK government (Lyons, 2013; Smith, 2013). It, however, suffered from major analytical errors, including selection bias of data, irreproducible results due to coding errors that meant the identified debt effects on growth should in fact have been much lower, and lacked a discussion on how the relationship between debt and growth might be reversed – that in fact low economic growth may lead to increased debt (Herndon et al., 2013; Wray, 2013). In addition to general disagreement over the impact of particular debt levels on economic growth, further debate surrounds the actual usefulness of austerity in reducing debt and rekindling economic growth, and also focuses also on its harmful societal implications. According to Blyth (2013), while austerity "is designed to reduce a state's debts and deficits, increase its economic competitiveness and restore what is vaguely referred to as 'business confidence'" (p.41), it not only "doesn't work" (ibid., p.42) but also entails high social costs, represented inter alia in unemployment levels not seen since the Great Depression. The lack of scientific evidence on necessarily adverse effects of debt on economic growth, and therefore the actual need for, and usefulness of austerity may lead to the conclusion that "policy makers abandoned the unemployed and turned to austerity because they wanted to, not because they had to" (Krugman, 2013).

Nevertheless, the EU not only sought to address what were viewed to be unsustainable financial and economic practices through the 2020 Strategy, but also issues of climate change. The Strategy thereby linked the environmental crisis with the GFEC as the same fundamental crisis of "monetary-and-ecological debt" (Cato and Read, 2009, 2). As this narrative of the 'double crisis' evolved (Bina and La Camera, 2011; Bina, 2013; Tienhaara, 2010), the notion of 'green growth' was embedded in several agendas, reports, and strategies of international organisations (UNEP, 2009; OECD, 2009; European Commission, 2010; UN ESCAP, 2012; World Bank, 2012). The concept of green growth envisages overcoming the resource intensive growth model of the past by creating more sustainable forms of economic growth (Everett *et al.*, 2010; Edenhofer and Stern, 2009; Jacobs, 2012; Zervas, 2012; Jänicke, 2012). Although green growth promises comprehensive economic benefits for the future, governments across Europe found themselves facing clashing policy objectives. They needed to reduce their government debt while simultaneously rekindling economic growth and advancing the expansion of renewable energy sources. Renewable energy transitions require extensive government support in providing a favourable regulatory framework and financial incentives to balance fossil fuel subsidies and higher capital costs (particularly for solar and offshore wind projects) (Owen, 2006; Nelson *et al.*, 2014).

There has been a long-standing debate on the role of income and economic development regarding the willingness and ability to induce environmental sustainability, for example, discussing a potential '(rich) north - (poor) south divide' in the European environmental policy context (Börzel, 2000, 2002; Lekakis, 2000). Generally, increasing development is commonly associated with a rising depletion of resources and pollution and is therefore seen to increase the need for greater sustainability (Martinez-Alier, 1994; Taylor, 2009; WWF, 2014). Lower income states may, however, lack the motivation, willingness and means to engage in environmental and climate action since they have more immediate necessities and/or lack the funds to invest in the environment (Martinez-Alier, 1994). Such arguments would also stand for a growing number of counties in the wake of the GFEC and austerity, as issues of growing unemployment levels and reduced government spending take precedence. Saving the environment may therefore be considered a luxury, reserved for the rich (Martini and Tiezzi, 2014; Pearce and Palmer, 2001).

Moreover, investing in environmental protection and climate action is perceived to burden consumers and businesses, resulting in a decreased economic competitiveness and thereby economic growth (Frondel *et al.*, 2010). Countries have therefore differed significantly in the policy instruments implemented to drive renewables and their general prioritisation of renewables as part of climate action (REN 21, 2017). While green growth and renewable energy transitions promise greater economic competitiveness and future reductions in energy costs in the medium to long run (Fabra *et al.*, 2015), even high income states may find themselves reluctant to embark on costly sustainability transitions particularly in light of immediate economic and financial pressures, as they are unlikely to provide much economic benefit in the short term (Frondel *et al.*, 2010). Indeed, this rhetoric on high income states being disadvantaged by improving their environmental footprint is all too present in public discourses in times of the Trump presidency (Bals and Hierl, 2017).

The thesis therefore picks up on a timely, complex, and pressing issue. It is divided into four distinct analyses, each examining a particular perspective and context of the role (or lack thereof) of the economic crisis and austerity for renewable energy transitions in the EU. The comparative analysis across EU member-states shows that different economic pre-conditions can be driving forces for renewable energy transitions, and indeed, conditions of both low- and high-income economies can equally well explain the expansion of renewables. Economic development, therefore, does not appear to be a determining factor in the commitment of states to advance their renewable energy transitions particularly in light of the 2020 targets. Subsequent case studies depict that economic and financial concerns do play an important role in the identification of how to support renewables. Indeed, the thesis shows how varying types of renewable energy and climate policies responded differently under austerity and in different societal, economic and political settings. The thesis addresses thus the underlying drivers and inhibitors of renewable energy transitions in times of crisis and identifies key factors for a successful regulatory framework driving renewable energy transitions.

Thus, as a whole, the thesis makes distinct contributions to the growing interdisciplinary literature on the economics and politics surrounding renewable energy transitions. It furthers our understanding of the role of contemporary economic and financial measures for the concurrent battle against climate change. The thesis provides a holistic contribution to contemporary issues in energy policy and energy economics. Additionally, the analysis's interdisciplinary approach allows further insights into aspects of general environmental, social and political science. By identifying potential challenges for contemporary climate action caused by the economic crisis and austerity, the findings of the project can further inform and drive measures to counteract any consequences undermining the achieving of crucial climate targets. In this regard, the analysis has a distinct applied contribution. It stresses the importance a fundamental commitment to sustainability transitions that results in long-term strategies, and requires an improved integration of the European energy market to achieve a more resilient, effective and efficient renewable energy transition.

1.2 Research Aim and Objectives

In this thesis, I analyse European renewable energy transitions in times of three concomitant crises. A crisis is commonly considered a critical turning point and represents a testing moment of the existing institutions and norms, providing opportunities for fundamental change, while also catalysing and unveiling underlying trends, dynamics and behaviours (Habermas, 1975; Claessens and Kose, 2013). I therefore seek to identify the dynamics that promoted or inhibited progress in the expansion of renewables at a time of economic recession and constrained government budgets. The overarching research question of this thesis is the following:

> *How have European renewable energy transitions fared during the economic crisis and austerity?*

With this investigation, I aim to:

(i) Improve our understanding of the driving forces and obstacles of European renewable energy transitions during times of crisis,

(ii) Identify the role of economic development on European renewable energy transitions,

(iii) Determine the effects of austerity for European renewable energy transitions, and

(iv) Enhance our knowledge of important factors for achieving successful renewable energy transitions.

1.3 Research Design

This investigation is located at the intersection of political science and economics. It captures a range of variables and factors shaping renewable policy by employing a set of different methodological approaches as part of an interdisciplinary analysis. The thesis thereby follows a classic linear structure of a deductive analytical approach, along the lines of the identification of a problem statement and the posing of relevant research questions, followed by their testing. In order to answer the key research question of this thesis, I employ a mixed methods research design, using a two-stage analysis based on Lieberman's (2005) nested-n approach. The nested analysis begins with a medium-n analysis (MNA) that refers to comparative study of the 28 member-states of the EU. This comparative analysis is followed by a small-n analysis (SNA) that encompasses an in-depth assessment of renewable energy transitions during the economic crisis and austerity in four selected case studies. The MNA uses Fuzzy-set Qualitative Comparative Analysis (fsQCA) in order to identify the relation between quantitative and qualitative indicators of the economy (the impacting or independent conditions) and the renewable energy transitions (the impacted or dependent condition). The SNA captures a selection of in-depth case studies that are free-standing and separate analyses.

As the purpose of the MNA is to establish a comparative picture across EU member-states, the SNA seeks to identify the particularities of each case within its given context. Rather than employing an iterative analysis of certain instances or phenomena across case studies, with a final comparison of identified themes or explanations, the thesis assesses every case study in light of its respective characteristics. This approach requires a range of different conceptual, theoretical and methodological frameworks to identify and measure respective findings. This range of methods helps to analyse complex qualitative and quantitative information to provide a complete understanding of the problem or question (Ragin, 1989, 2000; King *et al.*, 1994; Brady and Collier, 2004). Although this approach prohibits a rigorous comparative conclusion of the case studies, a comparison of similarities and differences across the analyses is conducted in the Conclusion.

While a large-scale comparative approach, such as the MNA, can provide a broader picture of general developments, case studies in the form of an SNA are the perfect means to assess the policies and underlying dynamics of renewable energy transitions at the state level. An in-depth analysis of selected case studies can thereby complement the more general overview provided by the MNA. King *et al.* (1994) stress that "reporting the precise rules by which we choose the small number of cases for analysis is critical" (23). This is done to minimise bias and ensure that cases are chosen based on merit (Luetgert and Dannwolf, 2009, 309).

1.4 Case Study Selection

I chose to carry out this analysis via national case studies to support the comparative findings of the MNA. The aim of these case studies is to examine renewable energy transitions in a national context during the economic crisis and austerity, to identify the dynamics, concerns, drivers and inhibitors of these transitions. Based on the respective findings, an improved statement can be made on where and how economic conditions come into play.

For the purpose of this thesis, the case-selection is informed by general economic and energy data of all member states drawn from Eurostat (2017a), as well as the author's theoretical and case knowledge. To provide a degree of comprehensiveness, the four case studies represent both high- and low-income EU member states, as well as countries that are Eurozone members, and those that are not.

For the two high-income countries, Germany and the UK were chosen. Germany, a Eurozone member and the largest European economy, showed a solid progress in expanding renewables under strong economic development conditions (Eurostat, 2017a), and indeed has been hailed a pioneer in expanding its renewable energy in the past (Bechberger & Reiche, 2004). Germany, thereby, represents the case of a rich state that has done well in expanding its renewables, however it is important to see whether its renewable expansion was nevertheless affected by the surrounding economic downturn. The UK, in turn, as a non-Eurozone member also fared reasonably well in its expansion of renewables, yet showed a high deficit that might have also played a role for its renewable energy transitions (Eurostat, 2017a).

For the two low-income countries, Portugal and Bulgaria were selected. Portugal, as a recipient of a financial bailout during the Eurocrisis, represents a contrasting example in terms of economic development, yet nevertheless showed one of the highest renewable expansion rates across the EU, raising questions about the relationship between economic development and renewable expansion (Eurostat, 2017a). Bulgaria, as the EU's member with the lowest income, yet also debt levels, represents an interesting case for analysis, as the country also did surprisingly well in expanding its renewables (Eurostat, 2017a).

The SNA case studies stand separate from each other, i.e. do not follow a pre-determined, comparative analytical system. This approach allows the SNA to move beyond factors of income and debt, and rather focus on contextual aspects that emerged from their analysis. As each case study takes place within a distinct political and economic environment, following the varying factors each case offers improves the ability to place the role of the economy within its appropriate context. This approach has strengths and weaknesses. On the one hand, it mitigates against a robust cross-case comparison. On the other hand, it allows context specific factors to emerge that might otherwise be missed by a pre-determined list of factors to consider. The cases therefore deliver an in-depth understanding of the factors surrounding renewable energy transitions by showing the complex relationship between renewables, politics and the economy, yet also identifying some potential commonalities across cases despite their differences.

1.5 Methods

In the MNA, I employ Fuzzy-set Qualitative Comparative Analysis (fsQCA), a variation of Qualitative Comparative Analysis (QCA). FsQCA is based on Boolean algebra and on a difference-making theory of causation. It further allows for the identifying of multiple causes and causal paths resulting in an outcome, called equifinality, which is crucial as causal structures in social sciences are highly complex (Ragin, 2000, 222). As a variation of QCA, fsQCA can refer to degrees of membership of a case to a condition by assigning scores between 0 and 1, with the point of indifference (0.5.) denoting cases that are neither members nor non-members of the condition or outcome (Schneider and Wagemann, 2012). This ability is essential as few of the conditions used in this analysis are absolutes. FsQCA lends itself to the nested-n analysis employed in this thesis as it is best applied to a relatively low number of cases, not exceeding 50 (Schneider and Wagemann, 2012). The limitations of fsQCA are overcome through the subsequent SNA, which focuses on the in-depth dynamics, contexts and other qualitative parameters of the selected cases of Germany, the UK, Portugal and Bulgaria (see Chapter 2.11).

As each SNA stands on its own merits, each analytical piece follows its own methodological and theoretical approach. This allows the analysis to address and incorporate the particularities of each case. As Norgaard (2003) stresses, focusing solely on a single approach to a complex field can prevent the establishing of a comprehensive image across multifaceted issues. By choosing a specific theoretical and methodological framework for each case, the analysis acknowledges their diverse conditions and situational particularities. The use of varying methods and frameworks across distinct cases renders the method selection context dependent (Schrøder, 2012). While the chosen approach does not allow for a rigorous comparison across cases, it enables the thesis to identify and focus on issues of particular importance in each case that may be irrelevant in another. Beyond the general perceptions established by the analysis, the thesis is thereby also able to highlight the diverse effects of austerity on renewable energy transitions. The thesis employs several distinct approaches to theory and measurement: the Index of Policy Activity (IPA), in Chapter Three, Historical Institutionalism (HI) in Chapter Four, and Energy Justice in Chapter Five.

The IPA, as developed by Schaffrin *et al.* (2015), is a tool to produce comparative data on change in the intensity of environment and climate policies. The IPA is applied to compare key renewable energy and climate policies since the late 1990s across two cases, Germany and the UK. The IPA provides a comprehensive approach to calculating the intensity of policies based on six indicators: objectives, integration, budget, scope, implementation and monitoring. With the ability to be applied to different energy and climate policies, the IPA provides a new way of comparative policy analysis for the two cases. Through its six indicators, the analysis is further able to pinpoint differences in policy developments in specific policy aspects. Indeed, the findings of the analysis identified the distinct ways in which the political and economic background influenced the effects of austerity on renewables in both countries, and the increasing cost concern of policies in the wake of austerity.

The Portuguese case most visibly depicts the clash of a country's sustainability ambitions and its fiscal requirements. Over the past decades, Portugal has been both at the forefront of the promotion of renewable energy and subject to repeated austerity programs due to a culture of overspending. As renewable energy policies have been impacted severely by fiscal consolidation measures, the analysis seeks to identify whether the financial crisis in Portugal resulted in a break with its traditionally supportive stance on sustainability. The case study therefore employs HI that is concerned with the emergence and evolution of institutions that represent certain structures and norms of social order, such as environmental and fiscal sustainability. These institutions are highly rigid, yet may be altered, reversed or replaced in face of a so-called critical juncture(Stefes, 2010; Capoccia and Kelemen, 2007; Capoccia, 2015; Collier and Collier, 1993; Pierson, 2000). I apply HI to analyse the potential clash of the two institutions of environmental and fiscal sustainability depicted through Portugal's renewable energy transition and its obligations under austerity. The findings of the analysis do not support the existence of a critical juncture, yet instead classify the effects of policy adjustments for the country's renewable energy transition as unintended consequences due to an unfavourable structure of the Iberian energy market.

Finally, the case study of Bulgaria employs energy justice as a novel approach of addressing issues surrounding the intra- and intergenerational justice implications of energy. As Bulgaria already reached its 2020 targets for renewable energy, energy justice provides an inclusive analysis of the processes behind the development and implementation of renewable energy and climate policies, as well as a valuable framework to analyse the economic, environmental and societal consequences of the renewable energy transition in the EU's poorest member-state (Heffron *et al.*, 2015; Jenkins *et al.*, 2016; Sovacool and Dworkin, 2015; McCauley *et al.*, 2013). The analysis of the drivers and consequences of Bulgaria's renewable energy transition highlighted the potentially adverse social and economic effects of the promotion of renewables in a corrupted and mismanaged political environment.

1.6 Data Sources

The analyses of this thesis are based on primary and secondary documents, as well as a set of semi-structured interviews conducted with 16 respondents affiliated to EU institutions, national government, non-government organisations, academia, the media and industry. The aim of these interviews was to provide a further analytical dimension to the thesis. As the research question and aims of this project seek to establish a 'cause and effect' relationship between austerity and developments in European renewable energy transitions, information from stakeholders linked to these developments or involved in the policy-making process can be of immense value.

A prevalent issue with the organising of interviews was the willingness of potential interviewees to participate. While over 50 emails were sent and selected calls made, in the end only 16 replied and agreed to be interviewed. The open ended, semi-structured interviews were held via Skype and in person between October 2016 and April 2017. The purpose of the interviews and the sets of indicative questions were subject to the ethical review of the University of York and received prior departmental permission. To prevent potential pre-conceptions to influence the interview, a set of indicative questions was prepared beforehand, agreed upon by the supervisors, and sent to each interviewee via email in advance of the interview. It was important that whilst questions were tailored to suit the interview context, they also reflected an objective approach to the subject area and were open to allow data to emerge naturally from the interviewees. Each respondent further signed a Form of Consent before the interview commenced, indicating his/her willingness to be recorded, transcribed and cited. Samples of these documents can be found in the Appendices and transcripts can be provided if needed.

The indicative questions served primarily to give the interviewee a sense of the aims of the study. However, in light of the diversity of the cases and the differing perspectives of each respondent, actually posed questions quickly adjusted based on the given information. As the lack of respondents undermined establishing of an overall comprehensive narrative, the interviews were not coded but served to triangulate the analysis, both guiding and reaffirming the findings from primary and secondary sources. This triangulation against other forms of data sought to address bias related to each interviewee's affiliation and in light of the limited number of overall interviews. The interviews enabled the verification of findings from other sources and vice versa, improving the validity of any analytical statement made in the thesis (Yeasmin and Rahman, 2012). Throughout the analysis, quotes from interviewees are hence used to support the findings.

The research consequently draws on a range of sources: primarily legislative papers, as well as government and non-governmental reports and analyses, and secondary peer-reviewed academic articles, books and chapters. Where appropriate, newspaper articles and other media sources were used. Statistical data were drawn from institutional and national data platforms, including the European Union (Eurostat, 2017a), the Organisation for Economic Cooperation and Development (OECD and IEA, 2015), and the World Bank (World Bank, 2017a, 2017b).

1.7 Thesis Outline

Chapter Two presents the medium-n analysis in form of a published article. It employs Fuzzy-Set Qualitative Comparative Analysis to establish causal inference between five conditions and the outcome across the 28 member-states of the EU. The Chapter seeks to identify causal set-relationships between several indicators of Eurozone membership and economic development (GDP growth, GDP per capita, and Government Debt and Deficit) with progress in renewable energy transitions. The results of the analysis both enhance our understanding of the impacts of economic welfare on renewable energy transitions, and serve to inform the subsequent case studies.

Chapters Three to Five present the small-n analysis of the four selected EU case studies (Bulgaria, Germany, Portugal, and the UK), which provide an in-depth assessment of the dynamics driving or inhibiting renewable energy transitions in different countries. Each case provides an additional facet to the overall picture of the implications of austerity for renewable energy transitions in different economic and political contexts. In Chapter Three I assess renewable energy transitions jointly in Germany and the UK during the economic crisis and austerity. The Chapter analyses potential changes in renewable energy transitions in two high income countries that have a strong history of climate action, but were differently affected by the economic crisis and austerity. To do so, I employ the Index of Policy Activity (IPA) to compare each country's renewable energy and climate policies.

Chapter Four focuses on Portugal, which has been a strong supporter of renewables in the past yet as one of the key crisis states of the Eurocrisis it had to adhere to severe austerity requirements under the Troika of European Commission, European Central Bank and International Monetary Fund. I apply Historical Institutionalism to determine whether the financial bail-out and subsequent entry of the Troika represented a critical juncture in the country's renewable energy transition.

In Chapter Five, I address the developments during times of crisis in a country that has neither a high income background, nor a history of supportive climate action; Bulgaria. As such, I identify the driving forces and the consequences of the rapid expansion of renewables during the economic crisis and austerity. I analyse the implications of Bulgaria's 'success' in expanding its renewable generation in terms of energy justice, to establish both benefits and burdens of renewable energy transitions in terms of improving the justice, equity and fairness of Bulgaria's energy system, as the country remains the poorest EU member-state in terms of GDP per capita and suffers from high levels of energy poverty and corruption.

Finally, in Chapter Six I discuss the overall findings of the analyses. Essentially, the thesis depicts a complex and ambiguous picture of the role of the economy and income for renewable energy transitions in general. While concerns related to austerity and the economic crisis seem to have affected renewable energy policies across several cases, the obligatory 2020 targets are highlighted as crucial in preventing stronger adjustments while advancing the sustainability of

Europe's energy systems. Based on these results, I provide some further conclusions and future policy recommendations.

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Chapter 2: Renewable Energy as a Luxury? A Qualitative Comparative Analysis of the Role of the Economy in the EU's Renewable Energy Transitions during the 'Double Crisis'

2.1 Preface

This chapter analyses the causal relationship between differing economic conditions and renewable energy transitions across the EU-28. It represents the medium-n analysis and is central to the thesis by establishing a comparative analysis across all EU member states. It does so by applying Fuzzy-set Qualitative Analysis (fsQCA) that has to date been little used in renewable energy research. The paper thereby makes a significant methodological contribution by being the first to apply fsQCA to test a specific hypothesis surrounding the effects of economic conditions on renewable energy. Furthermore, it is the first study to address explicitly the methodological issue of so-called 'model ambiguity' as identified by Baumgartner and Thiem (2015). As part of the analysis, the paper further provides a new way of conceptualising progress in renewable energy transitions as part of the 2020 targets through the creation of the POET indicator. The analysis of this chapter presupposes a link between a country's economic development and its ability and willingness to promote renewables. This assumption is based on two key characteristics of renewable energy transitions.

Firstly, although renewable energy sources (RES) benefit from a zero fuel cost-advantage (Klessmann *et al.*, 2008), they are considered expensive. Based on the production costs of for example wind turbines and the photovoltaic (PV) panels, as well as infrastructural costs, such as grid connection, foundations, and land rent, the initial capital costs of renewables are higher than those for traditional energy technologies (Boomsma *et al.*, 2012; Nelson *et al.*, 2014; Witt, 2013). Studies by Raugei (2012) and Hall *et al.* (2014) on the 'energy returned on investment' (EROI), which represents the ratio of invested energy needed to make the respective energy resource usable, showed a significantly lower EROI for wind (18:1), solar PV and geothermal energy (10:1) compared to, for example, coal (40-80:1). Similarly, Weißbach *et al.* (2013) assessed the 'energy money returned on invested' (EMROI), which integrates surrounding market factors to establish a better economic relationship between energy extraction and costs. His findings indicate that solar PV (unbuffered - 5.6/buffered - 2.4), biomass (4.8/4.8) and wind (42/11) are below other power sources, such as coal (49/49), gas (85/85), nuclear (100/100), and medium-sized hydropower (147/105).[1] The EROI and EMROI thereby depict the comparatively high costs of alternative renewable energy sources – at least as long as the full costs of the acquisition of fossil feedstocks and external costs, such as environmental and health damages due to pollution, are excluded from the cost calculations (Twidell and Weir, 2015).

Secondly, renewables require government support to be competitive, particularly to balance existing fossil-fuel subsidies. Indeed, the International Energy Agency has repeatedly stressed that fossil fuel subsidies are the greatest inhibitors of renewable energy transitions (2009, 2012, 2013, 2014, 2015). As of 2016, 176 countries have renewable policy targets in place and provide additional support for renewables through fiscal incentives, preferential pricing mechanisms and/or priority grid access (International Renewable Energy Agency, 2012; Mitchell *et al.*, 2011; REN 21, 2017). As such, renewable energy transitions can have a direct impact on government expenditures and revenues. Some policies receive direct subsidies from the government, increasing expenditures, others are provided in form of tax credits, reducing revenues. Through preferential pricing systems costs are borne by the utilities that are obligated to buy renewable electricity at a set premium. This electricity is then commonly sold at the electricity exchange, while the difference between the wholesale electricity price and the premium price is commonly transferred onto end-consumers, thereby increasing consumer electricity prices (Cherrington *et al.*, 2013; Morthost, 2010; Moreno and López, 2011).

[1] Buffering refers to the installing of "storage capacities to store the peaks, with reduced over-capacity plant installations" (p.212). Buffering is needed particularly for wind energy and solar PV and adds additional cost without additional useful energy output.

Through the additional costs imposed onto the energy system, several analyses also depict a potential negative effect of renewable energy transitions on the economy (Frondel *et al.*, 2010; Marques and Fuinhas, 2012; Berk and Yetkiner, 2014; Skovgaard, 2014; Grave *et al.*, 2015). Marques and Fuinhas (2012) show that the opportunity cost for renewables has been significant, resulting in a deceleration of economic activity and supplanting positive effects of job and income generation through renewables. Frondel et al. (2010) reiterate the effects of a high opportunity cost on employment balances, and depict how the particular policy environment in Germany has been "devoid of economic and environmental benefits" (p.4056). Berk and Yetkiner (2014) identify a negative and significant effect of energy prices on both GDP per capita and energy consumption per capita. They argue that under increasing renewable penetration energy prices are expected to decrease in the long-term, meaning current energy transitions also bear a positive economic growth potential. While primarily a policy issue revolving around the question how to pay for the incentives for renewables of the past years, also the case of Germany's exemptions for energy-intensive industries from the renewable surcharge show the relevance of energy prices for economic competitiveness (Jennrich *et al.*, 2014).

The chapter shows an ambiguous picture for the role of economic development in renewable energy transitions. It established that conditions for both lower and higher economic development resulted in a strong progress in renewable energy transitions. Through these results, the fsQCA shows that economic pre-conditions appear not to be the determining factors for the expansion of renewable energy. It thereby highlights the need for small-n case studies that can better identify particular drivers and inhibitors within a national context. Based on the analysis, the chapter selected four case studies – Bulgaria, Germany, Portugal, and the UK – that form the later small-n analysis. As conceptually, the role of income in sustainability transitions remains contested (Börzel, 2002, 2000; Martinez-Alier, 1994; Irene Lai and Yang, 2010; Martini and Tiezzi, 2014; Pearce and Palmer, 2001), the paper makes an important contribution to this ongoing debate.

This paper is written in the style of Ecological Economics to which it was submitted and accepted for publication. I declare that the work submitted is my own. The contribution of the co-author is as follows:

Dr. Charlotte Burns: supervision, review and editing.

Dr. Julia Touza: supervision, review and editing.

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Renewable Energy as a Luxury? A Qualitative Comparative Analysis of the Role of the Economy in the EU's Renewable Energy Transitions during the 'Double Crisis'

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2.2 Abstract

The European Union (EU) faces a double crisis: both economic and environmental, which has brought into stark relief the question of whether climate change mitigation and economic growth are mutually exclusive. Is saving the environment a 'luxury' reserved for rich countries, with less affluent countries being too poor to be green? We seek to address this important and timely question using fuzzy-set Qualitative Comparative Analysis (fsQCA) to analyse the causal relationship between economic growth and stability, and the expansion of renewable electricity shares among the European Union's (EU) 28 member states during the recent economic recession (2008-2013). Our paper, analyses the recent economic and financial crisis and its effects on sustainability transitions, and establishes a new indicator for progress in renewable electricity transitions in the context of Europe's 2020 targets. It therefore extends the 'sustainability as a luxury' debate to include renewable energy. The analysis reveals an ambivalent picture of the role of income in renewable energy transitions (RET) in Europe. Indeed, driven by the EU's common renewable energy targets, the findings suggest that RETs are promoted both because, and in spite of the means.

Keywords: Austerity; Economic Crisis; EU; Double Crisis; Renewable Energy; Qualitative Comparative Analysis

2.3 Introduction

This paper analyses *whether the economic and financial struggles of some EU member states have resulted in slower renewable energy transitions*. More specifically, we investigate whether the economic crisis has led to a division in the progress in expanding renewable electricity generation between economically stable and affluent EU member states and the weaker peripheries.

Following the financial crash of 2007/8, the European Union's (EU) economy plunged into a recession that officially ended in 2013 (Eurostat, 2017a).[2] Rising debt levels particularly in Eurozone states led to the widespread introduction of austerity measures. The EU further introduced its 2020 Strategy in 2010 that set binding emission, renewable and efficiency targets for governments on a path towards greener growth. The 2020 strategy thereby reflected the emerging narrative of a 'double crisis' that linked the economic and environmental crises (Bina and La Camera, 2011; Leichenko *et al.*, 2010; Bina, 2013; Tienhaara, 2010; Reinhart and Rogoff, 2009; UNEP, 2009; Read, 2009; Everett *et al.*, 2010; Edenhofer and Stern, 2009; Foxon, 2013). Measures to achieve sustainable development are, however, often perceived as costly and a potential drag on the economy (Skovgaard, 2014). A key question in this debate therefore concerns whether the protection of the environment has become a luxury. Crucially, can poorer countries afford to invest in renewable transitions when times are tough?

Drawing upon the literature on the relationship between economic development and sustainability we develop the following hypothesis:

> Low income EU countries have made poorer progress towards meeting their 2020 renewable electricity targets compared to high income EU countries.

This hypothesis is assessed through a fuzzy-Set Qualitative Comparative Analysis (fsQCA) approach as developed by Ragin (2000, 2008) that determines causal relationships between an outcome and multiple qualitative and quantitative conditions. We seek to identify which economic conditions are

[2] A recession refers to two consecutive quarters of no or negative growth, with the recession for the EU based on its average growth rates of all 28 member states.

minimally sufficient and minimally necessary for strong progress in the expansion of renewable electricity shares across EU member states. Progress in renewable electricity shares constitutes the outcome for our analysis and is represented through an innovative measure devised by the authors: the Progress of Renewable Electricity Transitions (POET) indicator. The timeframe of the analysis, the economic recession in the EU (2008-2013), constitutes an important moment.[3] Crises represent severe disruptions that test existing institutions and norms, providing opportunity for change, but also catalysing and unveiling underlying trends, dynamics and behaviours (Habermas, 1975; Claessens and Kose, 2013). We chose the focus on renewable electricity due to the decisive role played by the electricity sector in global environmental degradation and pollution (Heede, 2013).

Our paper enriches the existing debate in three main ways. Empirically, it provides a timely analysis set within the context of the recent economic and financial crisis and thereby contributes to the growing literature on how the crisis is affecting European climate and energy policies (Slominski, 2016). The focus on renewable electricity further provides a valuable new facet within the wider debate on 'sustainability as a luxury', due to energy's position at the critical junction of the economy (as its fundamental fuel) and the environment (as its primary polluter). We further provide a new way of conceptualising progress in renewable energy transitions (RETs) within the context of Europe's 2020 targets by establishing the novel POET indicator. Finally, methodologically, the application of QCA adds to a small but growing number of publications in the field of energy policy and environmental economics (Wright and Schaffer Boudet, 2012; Yamasaki, 2009; Crawford, 2012; Muench, 2015). This article represents the first application of QCA for testing a specific hypothesis surrounding the effect of economic conditions on renewable energy policies in times of economic crisis. To the best of our knowledge, ours is also the first study that explicitly addresses the issue of model ambiguities in QCA, a problem that has only recently been brought into focus by Thiem (2014b) and Baumgartner and Thiem (2015).

[3] The choice in timeframe was also dictated by the availability of data at the time of writing. Potential time lags between investment decisions made until their effects are visible in renewable energy data could therefore not be accounted for.

Below we briefly review the debates on the role of economic development in sustainability transitions; before providing a detailed outline of the use of QCA; in section four we present the results of the analysis before discussing them in section five. Section six provides some final remarks and conclusions. The analysis suggests an ambivalent relationship between economic development and renewable energy transitions in Europe: no significant gap emerged between high and low income EU countries' renewable energy transitions. As both indicators of higher and lower income are identified as causes for POET, the overall findings suggest that RETs are promoted both because, and in spite of the means. As such, the role of differing national, political contexts and the EU's common renewable energy targets as a fundamental driver of RETs should not be underestimated.

2.4 Renewable Energy: A Question of Means?

Debates about the relationship between economic development and environmental protection are long-standing. Inglehart's (1971) theory of post-materialism suggests that as economic and personal security expands, the acquisition of material goods becomes less pertinent vis-à-vis the desire to increase social goods of self-expression and a healthy environment (Booth, 2017). In the EU context, analysts have sought to determine if there is a '(rich) north - (poor) south divide' in environmental policy (Börzel, 2000, 2002; Lekakis, 2000). Martinez-Alier (1994) suggests that higher income states are more sustainable, for three principal reasons. More extensive sustainability measures in higher income states may be (i) based on the need to counteract growing resource dependence associated with increasing economic development, (ii) an attempt to benefit from the positive economic effects of sustainability, and (iii) due to the greater availability of means to invest in the environment (*ibid*.) – a prominent argument also related to the intra-European 'north-south divide' (Börzel, 2000, 2002). These analyses suggest three general motivators for government action, namely (i) the acknowledgment of a need for greater sustainability that leads to the willingness to act, (ii) a benefit from such action (motivation), and (iii) the means to act.

We can see willingness and motivation directly translated in the EU's 2020 Strategy that seeks to counteract anthropogenic climate change (willingness) and claims benefits of green and sustainable growth through innovation and efficiency (motivation). European countries are further 'motivated' to act by the threat of penalties if targets are missed (European Commission, 2013). It is important to note that some countries that have historically been more supportive of sustainability measures, or in this case renewable energy, such as Denmark, Germany, the Netherlands and Sweden, might have a greater willingness and motivation than other EU member states (Requier-Desjardins *et al.*, 1999; Cohen, 2000; Dryzek, 2005). Nevertheless, with the basic targets set through the 2009 Renewable Energy Directive and growth trajectories provided through the National Renewable Energy Action Plans (NREAP) by individual governments, a common, basic level of willingness and motivation can be considered a given. However, significant differences in the means available to facilitate greater sustainability remain, although a country's economic performance had been considered when renewable energy targets were initially set in the Renewable Energy Directive. Nevertheless, our question remains; how do these differences in the means (income) affect member states' RETs?

The existence of the double crisis and the two binding targets in the form of austerity and the 2020 strategy represent a significant challenge to policy-makers. The propagated fiscal consolidation is based on the belief that unsustainable government debt levels undermine the economic and financial stability of the Union (Checherita and Rother, 2010). Austerity measures thereby represent the enforcement of the European Monetary Union's (EMU) convergence criteria that require state government deficits to remain below 3 percent of Gross Domestic Product (GDP) and government debt below 60 percent of GD At the same time, the 2020 strategy seeks to address issues of environmental degradation, pollution and anthropogenic climate change through setting binding targets that seek a 20 percent reduction of greenhouse gas (GHG) emissions (based on 1990 levels), a 20 percent increase in renewable energy and a 20 percent improved energy efficiency

(European Commission, 2010). For the renewable sector these targets are based on the 2009 Renewable Energy Directive that followed the 2008 climate change and energy package.[4]

While RETs are an important tool in mitigating the effects of anthropogenic climate change, considering the polluting effects of conventional energy sources (Heede, 2013), RETs are neither the cheapest nor the most effective way to do so (Apergis and Payne, 2012; Darwall, 2015). Replacing existing conventional power plants with renewables requires government support to create a favourable policy and investment environment that could be undermined through extensive fiscal consolidation programmes (Busch *et al.*, 2013; Alesina and Ardagna, 2012). Although RETs do not necessarily impose an additional burden on the state budget, as many renewable policies transfer costs onto end-consumers, they are seen to increase electricity prices (Sensfuß *et al.*, 2008; Sáenz de Miera *et al.*, 2008; Klessmann *et al.*, 2008). The installation of renewables has also been associated with a decrease in a country's income in the form of GDP per capita (Silva *et al.*, 2012). Renewable electricity sources are therefore considered expensive *vis-à-vis* fossil fuels if the further societal and environmental benefits from renewables are not internalised. Hence, the economic effects of RETs fail to align with, and may even seem to directly contradict, the need to overcome the economic recession.

Sustainability transitions have therefore often been considered the preserve of rich, developed countries that can afford to carry the financial and economic burden of being green. Yet the literature assessing environmental quality in terms of being either a 'normal' or a 'luxury' economic good shows an ambivalent picture: it has been identified both as a normal (Kristrom and Riera, 1996; Aldy *et al.*, 1999; Ready *et al.*, 2002) and luxury good (Pearce and Palmer, 2001; Irene

[4] The Commission sought to increase these targets during the crisis (Skovgaard, 2014). In October 2014 the European Council introduced the framework for climate and energy that set a target of 27% renewables in final energy consumption by 2030. A proposal by the Commission from November 2016 calls for member states to combine their actions to ensure the meeting of these targets and envisaged a greater coordinating role for the EU and was aimed at complementing the Energy Union Governance (European Commission, 2016b). The Energy Union itself was identified as a priority project by the Juncker Commission and seeks to establish a fully integrated European energy market to improve energy security and efficiency, decrease prices and carbon emissions, and improve competitiveness and research and innovation (European Commission, 2017b).

Lai and Yang, 2010; Martini and Tiezzi, 2014).[5] It, therefore, does not seem a given that the richer a country, the greater the willingness to pay for environmental quality, or in turn, that poorer countries are necessarily less sustainable.

As the role of means in driving sustainability transitions, therefore, appears to be inconclusive, this paper seeks to test the two fundamental assumptions of the current debates that are represented through our hypothesis.

2.5 Methodology and Data

QCA is a method of causal inference based on a difference-making theory of causation, and has been applied in a growing number of papers across many disciplines (Ragin, 1989, 2008; Schneider and Wagemann, 2012; Baumgartner and Thiem, 2015; Baumgartner, 2014).[6] QCA focuses on the causes of an outcome (B is caused by A) rather than the outcomes of a cause (A leads to B) (Katz *et al.*, 2005; Baumgartner, 2014), which makes it “a powerful tool [in] testing hypotheses or existing theories” (Berg-Schlosser *et al.*, 2009, 16). One of QCA’s advantages is the ability to establish equifinality by identifying multiple causes and causal paths affecting an outcome, which is crucial as causal structures in social sciences are highly complex (Ragin, 2000, 222).

Whether a condition or a set of conditions is a difference-maker is established through patterns, called configurations. QCA configurations follow notions of sufficiency and necessity in relation to the outcome (Schneider and Wagemann, 2012). A sufficient condition is a condition that whenever it is present, so is the outcome. However the outcome can also be present in the absence of the condition, indicating the possibility for the outcome to occur for reasons other than the condition. The condition is therefore sufficient (every time it is present, the outcome is) but not necessary, since not every time the outcome is present, the condition is too.

[5] Luxury goods in private consumption present an income elasticity of demand that is greater than unity, or put differently, a good for which demand increases more than proportionally as income rises.

[6] “[D]ifference-making theories stipulate—as their name suggests—that causes are characterized by their property of making some sort of difference to their effects, where the relevant sort of difference-making is variably specified in different theories” (Baumgartner, 2014, 3)

In order to identify the difference-maker(s) of the outcome and, hence, its causes, necessary and sufficient conditions need to be freed of all redundancies (Baumgartner, 2014; Thiem and Baumgartner, 2016). Redundancies are factors that can be removed from conditions without altering a condition's expression of sufficiency or necessity. This means that when "A is sufficient for [an outcome] E, it follows (on mere logical grounds) that AX is also sufficient for E, and when A is necessary for E, it follows that A v X is also necessary for E, where X in both cases stands for an arbitrary factor" (Baumgartner, 2014, p.3). The removal of redundancies is achieved through a two-phase minimisation process (*ibid.*). This minimisation uses the Quine-McCluskey optimisation, which maps every configuration and its respective membership (or non-membership) of conditions and the outcome to identify implicants, those configurations meeting the outcome. In a next step, the method generates so-called prime implicants (PI) of a function. These implicants cannot be covered by a more general implicant, and therefore are minimal, i.e. without redundancies. If a PI covers an output of the function not covered by any other combination of PIs, this PI is called essential. One therefore differentiates between essential and inessential PIs.

The overall minimization process is inhibited by limited diversity, which refers to a situation in which not every logically possible configuration of conditions is observed. To address the issue of limited diversity, the number of conditions should be kept low relative to the number of cases through not exceeding its root (√number of cases) (Berg-Schlosser and De Meur, 2009). This rule allows for results that may be tested, and thereby corroborated or falsified, which is essential for the scientific quality of the method.

For this analysis of 28 EU states, we chose five conditions as a maximum. Using Thiem's (2016) QCApro extension package for the R environment, we built the parsimonious solution as it is the only reliably causally interpretable solution (Baumgartner, 2014). The minimisation process as a whole follows indicators of coverage and inclusion. Coverage refers to the degree to which cases exhibiting the outcome agree in exhibiting at least one combination of conditions and provides a sense of empirical relevance (Ragin, 2000; Schneider and Wagemann, 2012; Legewie, 2013).

Inclusion refers to "the degree to which cases sharing a given combination of conditions agree in displaying the outcome in question" (Ragin, 2008, 44). It thereby represents the strength of the set-relationship In cases of configurations of multiple sufficient causal paths to an outcome, the causal configuration with the highest unique coverage can be considered most important, when the inclusion score is high (Ragin, 2008, p63–68). As real-world examples render full inclusion levels of 1 rare, the inclusion rate can be lowered as low as 0.75 (Ragin, 2008), yet other minimum levels have been identified as well, such as 0.8 and 0.9 (Thygeson *et al.*, 2012; Ragin *et al.*, 2008). Furthermore, Ragin *et al.* (2008) claim that the coverage should not be below 0.75 (78). While there is a common trade-off between a higher inclusion and a higher coverage, no indicator exists on what constitutes the right balance for the solution to be empirically and theoretically compelling. The general strength of a causal model is calculated through the product of the inclusion and the coverage. To accommodate the above differences in approach and ensure the strongest possible result, we sought causal configurations that would show both the highest possible inclusion and coverage. As such, we ran the analysis from the top, with a cut-off of 1.0 and gradually lowered the inclusion score until the coverage score in the consequent model reached at least 0.8. It is important to note that during fsQCA analyses, the final inclusion score of a model can be below the initial cut-off and such models have not been considered in our analysis, as they do not adhere to the requirements initially set through the cut-off.[7]

In fsQCA, each condition is assigned a membership score between 0 (non-membership) and 1 (full membership) by decimal place. It can thereby express data in relative terms to other data and with respect to a given context or a designated benchmark. The notion of 'fuzzy' in fuzzy-set therefore refers to unclear conceptual boundaries of, for example, development is a matter of degree (one can be more or less developed), and relative depending on its context (Schneider and Wagemann, 2012). The point of indifference, 0.5, represents the cross-over between membership

[7] To our knowledge, there has been no solution for this issue so far, and although not common practice in current fsQCA applications, to circumvent current problems in the QCA protocol, we only consider models with an inclusion score that meets the initial cut-off.

and non-membership and acts as a qualitative anchor (Schneider and Wagemann, 2012; Thiem, 2014a).

2.5.1 The Conditions and Calibration Parameters

QCA relies heavily on extensive theoretical reflection and empirical pre-knowledge on the cases. Sensitivity analyses on the robustness of, for example, choice in conditions, the calibration approach used, and the results, are therefore not commonplace in QCA analyses, although some literature encourages them (Skaaning, 2011; Cooper & Glaesser, 2016). As by nature of QCA, decisions in the choice of conditions and setting of calibration thresholds follow the intimate knowledge of theory and cases, which is seen to minimize potential problems (Skaaning, 2011; Schneider & Wagemann, 2012). The decision in this analysis to compute calibration thresholds based on data ranges (mean) and policy targets (convergence criteria) was made to further prevent biases that can present in more arbitrarily chosen thresholds common in QCA applications. Multiple cut-offs are later chosen to ensure the robustness of the results and test for sensitivity. Nevertheless, no sensitivity test was conducted on the calibration thresholds, for the reasons identified above.

The choice in conditions for this analysis is impacted by the limitations of data and the focus of the analysis. Based on these factors, we identified the following five conditions: Eurozone membership, GDP per capita, real GDP growth, government debt, and governmental deficit. We drew the data for the analyses from Eurostat (2017a) and the Worldbank (2017a), with each country's 2020 target considered according to its NREAP renewable electricity target (RES) (European Commission, 2016a). Based on these data, we consider renewable electricity to include small and large hydropower, as well as biomass, geothermal, solar and wind. An overview of the calibration of conditions can be seen in Table 1 and is further explained in the following to enhance replicability.

Table 1: Outcome and Conditions Calibration Patterns

The anchor points of non-membership (0.00), indifference (0.50) and full-membership (1,00) are set based on qualitative knowledge or calculated around the mean. The latter implies the rounded down mean of the condition's data as threshold, with double of the mean set as full membershi All qualitatively informed anchor points are explained speficially.

Outcome	**Measures**	**Anchor Points**
Renewable Energy Share Progress	Change in Renewable Electricity Share, 2008-2013.	Calculated around mean of data. (1.00 = strong progress; 0.5 = neither weak nor strong progress; 0.0 = no progress)
Renewable Energy Share Achieved	Share of renewable electricity achieved of 2020 target in 2013.	Full achievement means full membership, other anchors set accordingly. (1.00 = Achieved 2020 target, excellent achievement; 0.50 = half way towards achievement; 0.00 = no achievement)
Conditions		
Eurozone Membership	Full accession to the Eurozone	(1.00 = yes, 0.00= no)
GDP per Capita	Average GDP per capita between 2008-2013.	Calculated around mean of data. (1.00 = rich EU member state; 0.50 = neither rich nor poor EU member state; 0.00 = poor EU member state)
Real GDP growth	Average real GDP growth between 2008-2013.	Calculated based on spread of data set, around no growth (0). (1.00 = strong GDP growth; 0.50 = neither positive nor negative growth; 0.00 = strong negative growth)
Government Debt	Average government debt between 2008-2013.	Calculated according to Maastricht convergence criteria, with threshold set at 60% of GD (1.00 = Very high debt; 0.50 = Meeting convergence criteria; 0.00 = Less debt than convergence criteria)

Governmental Deficit	Average governmental deficit between 2008-2013.	Calculated according to Maastricht convergence criteria, with threshold set a 3% of GD (1.00 = Very high governmental deficit; 0.50 = Meeting convergence criteria; 0.00 = Lower governmental deficit than convergence criteria)

2.5.2 The Outcome

The POET indicator consists of two variables; each member states' renewable electricity share progress (RESP) over the period of analysis, and the share achieved of each member states' 2020 renewable electricity target as of 2013 (RESA).[8] The final calibration score of the outcome is the average of the two separate variables' calibration scores.

We calibrated RESP around the rounded-down mean of the data, with double the mean necessary to reach full membership. The mean of 7.6 translated into calibration scores of 0, 7, and 14. In the context of membership, they imply that countries with a renewable electricity share increase of 14 percent or more are a full-member, showing very strong growth, while those between 7.1 percent and 13.9 percent show strong growth receiving membership scores of 0.51-0.99. Countries with renewable electricity share increases between 0.1 and 6.9 percent show weak growth, indicating their non-membership through scores of 0.01-0.49, and those at 7 percent show neither strong nor weak growth (0.5). As it cannot reasonably be expected that a country met more than its 2020 target by 2013, the thresholds for the RESA were set at 0, 50 and 100, meaning every country that already achieved its 2020 target in 2013 received a full-membership score.[9]

We focus on renewable electricity 'shares', rather than capacity or generation levels, since the 2020 targets are expressed this way. As RESP also stands relative to the total electricity

[8] As aforementioned, we chose the timeframe of 2008-2013 as it was the time from the beginning of the financial crisis until the official end of economic recession.

[9] It should be noted that a sensitivity test of this calibration threshold has not been conducted, due to the above argument on reaching the 2020 target.

produced, possible general declines in total electricity generation (and consumption) due to the economic downturn are taken into account. Combining RESP and RESA allows for the representation of change in renewable electricity shares relative to other member states' progress, as well as to each member states' own capabilities and ambitions. We joined the two variables, therefore, due to each individual one's explanatory shortcomings. For RESP, the share increase relative to other countries can be impacted by the differing sizes of countries' electricity markets as well as already installed base levels of renewable electricity as of 2008. Installing, for example, one wind farm on a smaller energy markets can make a significant difference for the renewable electricity share, unlike in countries of larger electricity markets. Also, a higher base level can affect the pace in which significant changes can take place over the period of study, considering different levels of market saturation under current technological conditions. RESA, while only representing a single point in time, puts progress in renewable electricity share in a solely domestic context, based on national endowment, investment and ambition. Indeed, the combination of the achievement condition with the general progress in renewable electricity compared to other EU states also provides an idea of how ambitious the state's targets are (for example, when a state has shown strong progress compared to EU members but very little regarding its targets, the latter might have been too ambitious). Jointly, the two variables balance some of the interpretational pitfalls and provide a more comprehensive picture of the outcome (POET) in each EU member state.

2.5.3 The Five Conditions

The first condition recognises whether a country is a member of the Eurozone or not. The Eurozone stood at the centre of financial attention during the financial crisis through its own Euro-crisis. The condition thereby provides a particular perspective on the role of austerity for renewable energy expansions. Generally, all EU-28 member states are members to the Stability and Growth Pact and therefore have to adhere to its debt and deficit targets. However, the shortcomings of the Euro-system, limiting of national responses to fiscal policies (monetary policies available to countries with their own national policy were implemented centrally through the European Central Bank for the entire Eurozone), and effects of several crisis states that required financial bailouts on the rest of the Eurozone provided a particular focus on fiscal austerity for the Eurozone. In light of the aims of this analysis, we use the Eurozone condition therefore to identify whether being part of the Eurozone during its crisis made a difference to the progress of a country's renewable energy expansion. It, hence, adds a political dimension to the other four conditions that in turn relate to a country's economic development from different perspectives. The Eurozone condition's calibration provided every Eurozone state with a score of 1, and the remaining EU members with a 0. Denmark, although part of the Exchange Rate Mechanism II, under which the national currency is allowed to float against the euro, is also given a non-membership score, as factually, Denmark does not have the Euro and hence is not part of the Eurozone. The condition's abbreviation during the analysis is EURO.

GDP per capita captures the central aspect of the hypothesis that a sustainable electricity generation is costly and reserved for high income countries. GDP is the standard measure of economic performance at the national level. It represents the market value of all final goods and services produced within a country over a given period of time, usually a year. GDP per capita aims to represent the income and expenditure of the average person in the economy. Although GDP has several known shortcomings as it ignores, for example, the economic activities placed outside the market (e.g. home production, volunteer work and recreation) and social inequalities in income distribution (Stiglitz *et al.*, 2010), we use it in our analysis as a standard used indicator about the per capita income. This is due to the fact that production is related to a country's income-related issues, such as standard of living, wages, and unemployment. Through GDP per capita, we identify the actual income differences of EU countries. The calibration was based on the average annual GDP per capita of each EU member state between 2008 and 2013 that enables the representation of a country's change in GDP per capita over the course of the crisis. We calibrated the condition based on the rounded-down mean, as before with RES With a mean of 33,285USD, the condition's thresholds were set at 0USD, 33,000USD and 66,000USD. The condition's acronym is GDPPC.

Real GDP growth sheds light on the role of the economic development of a state in the context of RETs from a slightly different angle. It serves as an indicator for the change in size of a country's economy, representing the welfare and stability of an economy. Using real instead of nominal GDP accounts for inflation, thereby adjusting GDP rates for different price levels at different years, enabling a better judgment about improved or worsened conditions in a country relative to others. As part of the analysis, we use GDP growth as an indicator for the stability of each country's economy, providing a sense of how each case was affected by the crisis, affecting also investment environments for renewables. High GDP growth rates in a country are therefore considered in line with good economic development. With a minimum value of -4.95, a mean of -0.14, and a maximum value of 3.02, our calibration of this condition was unable to follow the computational approach used with RESP and GDPPC. Consequently, the spread of the data from a rounded -5 to 3 was taken and divided by 2. By setting the cross-over at the centre, the thresholds were set at -2, 0, 2. The division by two set the thresholds below the minimum and maximum values in order for countries to be able to reach a full and a full non-membership score. It should be noted that with the cross-over at zero, countries below this threshold have negative growth. The condition's acronym is GDPG.

The fourth and fifth conditions on deficit and debt are closely related, and refer to two EMU convergence criteria that are the basis for the implementation of austerity across the Eurozone. The size of government debt and deficit can therefore hint at the severity of imposed austerity measures. The condition thereby provides an important perspective for testing the hypothesis related to the financial means available to a government. While a large-sized government deficit could also represent a government that is not austere, by January 2012, every EU member state had officially embarked on a path of austerity (Šonje, 2012; Melchiorre, 2013). To reiterate, the convergence criteria require that the annual governmental deficit relative to the country's GDP does not exceed 3 percent, and the overall gross government debt relative to GDP at market prices does not exceed 60 percent (European Commission, 2015b). It should be noted that both criteria are closely linked to the GDP growth of a country, since they are connoted in portion to overall GDP;

potential slumps in the economy could therefore lead to an expansion of government debt to GDP ratio, despite reduced government spending (Alesina *et al.*, 2014; Pedroso, 2014). We calibrated the conditions by their aggregate average over the five-year period of analysis according to each condition's target as set in the convergence criteria. For debt, thresholds were identified as 0, 60, 120. The acronym for this condition is DEB. For governmental deficit the calibration had to take into account a budget surplus as well as deficit. The condition's thresholds, in accordance to the criteria, were hence set at 0 (making every state with a balanced budget or a surplus a full non-member), -3 (representing the criterion's 3 percent deficit) and -6. The acronym for this condition is DEF.

2.6 Results

Table 2 shows the results of the calibration and includes the RESP and RESA scores used to estimate the POET index to provide a better understanding of the underlying dynamics of the outcome. Considering the results, the two variables are similar (within 0.1 points of each other) in only nine countries (Belgium, Germany, Spain, Italy, Cyprus, Latvia, Lithuania, Malta, Netherlands) that therefore show an aligned progress in renewable energy shares towards national targets domestically and compared to other member-states. The remaining cases in which RESP and RESA scores diverge by more than 0.1 scores can be further divided into the five with a better RESP than RESA score (Denmark, Ireland, Greece, Portugal, United Kingdom) and the remaining 14 that scored better in the RESA (Bulgaria, Czech Republic, Estonia, France, Croatia, Luxembourg, Hungary, Austria, Poland, Romania, Slovenia, Slovakia, Finland, Sweden). The better RESP score for Denmark, Ireland, Greece, Portugal and the UK implies that these states may have adopted overly ambitious 2020 targets, while for the other 14, the opposite is true. It should be noted that none of these scores is making any statement about whether countries are more or less likely to reach their 2020 targets, as they are merely comparing progress levels between 2008 and 2013.

Table 2: Calibration Results

Country	Outcome			Conditions				
	RESP	RESA	POET	EURO	GDPPC	GDPG	DEF	DEB
Belgium	0.55	0.59	0.57	1	0.7	0.63	0.6	0.84
Bulgaria	0.64	0.92	0.78	0	0.11	0.69	0.25	0.13
Czech Republic	0.54	0.95	0.75	0	0.31	0.53	0.56	0.32
Denmark	1	0.83	0.92	0	0.91	0.33	0.26	0.35
Germany	0.75	0.66	0.71	1	0.67	0.67	0.25	0.63
Estonia	0.78	1	0.89	1	0.25	0.37	0.11	0.06
Ireland	0.69	0.49	0.59	1	0.79	0.37	1	0.75
Greece	0.83	0.53	0.68	1	0.4	0	1	1
Spain	0.91	0.91	0.91	1	0.48	0.18	1	0.56
France	0.19	0.63	0.41	1	0.64	0.6	0.87	0.69
Croatia	0.56	0.99	0.78	0	0.21	0.07	0.91	0.5
Italy	1	1	1	1	0.56	0.14	0.6	0.97
Cyprus	0.45	0.41	0.43	1	0.47	0.3	0.72	0.56
Latvia	0.72	0.82	0.77	1	0.21	0.15	0.75	0.31
Lithuania	0.59	0.62	0.6	1	0.21	0.61	0.94	0.27
Luxembourg	0.12	0.45	0.29	1	1	0.73	0	0.16
Hungary	0.09	0.61	0.35	0	0.21	0.37	0.64	0.65
Malta	0.11	0.12	0.12	1	0.32	0.98	0.54	0.56
Netherlands	0.19	0.27	0.23	1	0.79	0.48	0.58	0.51
Austria	0.21	0.96	0.59	1	0.75	0.65	0.48	0.66
Poland	0.45	0.56	0.5	0	0.2	1	0.86	0.44
Portugal	1	0.89	0.94	1	0.34	0.18	1	0.86
Romania	0.67	0.88	0.78	0	0.13	0.74	0.9	0.24
Slovenia	0.2	0.83	0.52	1	0.37	0.23	1	0.37
Slovakia	0.29	0.87	0.58	1	0.26	0.96	0.8	0.35
Finland	0.27	0.94	0.61	1	0.74	0.31	0.18	0.39
Sweden	0.59	0.98	0.78	0	0.84	0.66	0.03	0.32
United Kingdom	0.6	0.45	0.52	0	0.62	0.59	1	0.62

Overall, four countries made extremely strong progress (0.90-1.0), eight countries showed very strong progress (0.65-0.89), eight countries showed strong progress (0.51-0.64), one country showed neither strong nor weak progress (0.50), three countries showed weak progress (0.34-0.49), and three countries showed very weak progress (<0.35), with the lowest score being 0.12 (Malta). It is therefore also noteworthy that only France, Cyprus, Luxembourg, Hungary, Malta and the Netherlands received a 'weak' POET score of below 0.5, of which France and Hungary had at least a partial score above 0.5. Poland is the only country that received an overall score of 0.5, rendering it a country that neither showed strong nor weak progress in its RET. This means that 21 out of 28 cases show strong progress in RETs. This group includes five of the six European Debt Crisis states (Portugal, Italy, Greece, Spain, Ireland, yet not Cyprus), with Italy, indeed, receiving the highest score among the EU-28. Since Italy achieved full membership in both variables, meaning its increase in renewable electricity share has been one of the strongest among EU countries, this success seems to be authentic and not due to an unambitious 2020 target. A first look at the calibration scores in light of the hypothesis already indicates that there is no clear gap among more affluent states and poorer states regarding a weaker progress in RETs in the latter; several countries with low scores in GDPPC and GDPG, such as Croatia, Latvia, and Slovenia, received POET scores of above 0.5.

Table 3: Six identified models, their cut-offs, inclusion, coverage scores, overall strength and causal paths. *Product of Inclusion and Coverage

	Cut off	Incl.	Cov.	Strength*	Model						
1	0.97	1	0.694	0.67318	EURO*gdppc*gdpg +	(euro*deb)					=> POET
Unique Coverage:					*0.394*	*0.035*					
2	0.95	1	0.723	0.69336	EURO*gdppc*gdpg +	(euro*deb +	euro*GDPPC)				=> POET
	0.94	1	0.723		EURO*gdppc*gdpg +	(euro*deb +	euro*GDPPC)				=> POET
Unique Coverage:					*0.394*	*0.028*	*0.01*				
3	0.89	0.9	0.883	0.7914	def*DEB +	(euro*GDPPC+	EURO*gdppc+	gdppc*deb+	GDPPC*gdpg)		=> POET
Unique Coverage:					*0.028*	*0*	*0*	*0*	*0*		
4	0.89	0.9	0.883	0.7914	def*DEB +	(euro*deb +	euro*GDPPC +	EURO*gdppc +	GDPPC*gdpg)		=> POET
Unique Coverage:					*0.028*	*0*	*0.01*	*0*	*0*		
5	0.89	0.9	0.874	0.7831	def*DEB +	(DEF*deb +	euro*GDPPC +	EURO*gdppc +	gdppc*def +	GDPPC*gdpg)	=> POET
Unique Coverage:					*0.028*	*0*	*0.01*	*0*	*0*	*0*	
6	0.89	0.9	0.874	0.77786	def*DEB +	(DEF*deb +	euro*def +	euro*GDPPC +	EURO*gdppc +	GDPPC*gdpg)	=> POET
Unique Coverage:					*0.028*	*0*	*0*	*0*	*0*	*0*	

To ensure the robustness and test for the sensitivity of the result, the analysis employed several different cut-offs. It identified six different models at seven different cut-offs in which the final inclusion score was equal to, or higher than the initial cut-off. The notion of inclusion provides a sense of the robustness of the result. With inclusion cut-offs between 0.89 and 0.97 this shows a strong robustness in the results (0.75 being considered a common threshold). By incorporating several different cut-off threshold, the analysis further accounted and included additional solutions, to address a potential sensitivity to change.

The models are shown in Table 3, with the inessential PIs in brackets. Upper-cases refer to the presence of an outcome, with lower-cases representing its absence. The highest cut-off that resulted in a model was at 0.97, while the model crossing the 0.8 coverage threshold was achieved at a cut-off of 0.89. As expected, the various models depict a gradual trade-off between the inclusion and coverage scores. Considering the unique coverage of each causal path, the highest score of 0.394 is assigned to the PI 'EURO*gdppc*gdpg' in Model 1 and 2 (M1 and M2). However, M1 and M2 have a low coverage of around 0.7, meaning that there exist several cases featuring the outcome that cannot be explained by the model, which is reflected in an overall strength of the models below 0.7. As such, the model of fit of M1 and M2 is less than with the other four models at the low cut-off of 0.89. Indeed, model three to six have a high coverage of 0.87/0.88 and a strength of between 0.77 and 0.79.

2.7 Discussion

It is important to highlight that through the calibration, we identified 21 out of 28 EU member states with a strong POET (score above 0.5). This result indicates that there has been a solid support and achievement in promoting the expansion of renewable electricity in the EU, with only a few laggards since the economic downturn. However, the model ambiguity – represented through the six different models – shows that the data are insufficient to determine a data-generating causal structure. As technically, only one of the models can represent a causal path, the causal modelling is underdetermined. Consequently, we focus our analysis, firstly, on the four strongest models (M3, M4, M5, and M6) that are all included due to the fact they are all generated from the same cut-off, and secondly, on the common elements shared across these four models, as their causal relevance is supported by the data, and they, therefore, constitute a sufficiently informative result. Indeed, we can only causally interpret these common paths, as elements appearing in only some models are not clearly identifiable as causes. There are four common elements across M3-6 (compare Table 3): (i) def*DEB, (ii) euro*GDPPC, (iii) EURO*gdppc, and (iv) GDPPC*gdpg. Although with the exception of the first path, all elements are inessential PIs, their repeated occurrence as causes for strong progress in RETs across the models renders them highly noteworthy.

Considering the first element of (i) a low deficit and high debt, 'def*DEB' is the essential PI in all four models at the cut-off of 0.89. A low deficit and a high debt could indicate a case in which fiscal consolidation is taking place following prior fiscal expansion that supported the progress in RETs. It could also reflect a debt structure, in which debt is weighted towards long-term, low interest liabilities. As capacity expansion of renewable energy can take up to five years from the securing of funding until entering the market, the strong POET may be the result of a more favourable investment environment prior to the introduction of austerity, which has generally been associated with increased uncertainty over investment (Alesina *et al.*, 2014; Busch *et al.*, 2013; Corsetti *et al.*, 2012). The introduction of austerity and the therefore potentially worsening investment environment, however, could also mean that the progress in renewable energy transitions will be slower in the future.

The second and third elements both relate to Eurozone membership and GDP per capita, in opposite contexts, meaning one path (ii) refers to non-Eurozone membership and a high GDP per capita (euro*GDPPC), and the other (iii) to Eurozone membership and a low GDP per capita (EURO*gdppc). These elements also partly appear in M1 and M2. Crucially, 'euro*GDPPC' seems to affirm that a rich country that has not suffered under Eurozone-crisis can afford to invest in renewable energy. For example, Denmark and Sweden, who represent such cases are well-known for their high-income, stable economies, and their pioneering role in sustainability efforts and renewable energy (Jänicke, 2008; Mathiesen *et al.*, 2011).

By contrast however, (iii) 'EURO*gdppc' directly contradicts our hypothesis that low income states are too poor to be green. It is, however, also similar to the results of Hess and Mai (2014), who find that poorer Asian countries have higher levels of renewable electricity. In the European context, there are several potential explanations for this result. Four of the seven observed cases (Greece, Spain, Cyprus, Portugal) meeting the path received bailout packages from the 'Troika' of the European Commission, European Central Bank, and International Monetary Fund (European Commission, 2014, 2017a). While, therefore, these crisis-ridden countries had to adhere to strict austerity measures as part of the packages' requirements, this international support may have reassured investors and facilitated the development of renewable energy policy capable of meeting the countries' 2020 targets. The renewables sector may also have profited from the necessary re-structuring and reforming of these countries' economies encouraged through the concept of 'green growth' embedded in the 2020 strategy , which aims to achieve economic growth without the large and irreversible negative effects on the environment (Jacobs, 2012; Van Der Ploeg and Withagen, 2013; OECD, 2014). The combination of Eurozone membership and low GDP per capita also exists in combination with low GDP growth in M1 and M2 as both models' essential PI. In this combination it represents the highest unique coverage of 0.394, and can thereby explains almost 40% of cases with the outcome.

The fourth element, of (iv) high GDP per capita and low GDP growth, again appears to affirm our second hypothesis about higher income states showing better progress in renewable energy transitions. This finding suggests that developed countries, or high-income countries, achieved a high standard of living while economic growth rates fall to lower levels, and includes Denmark, Ireland, Italy, the Netherlands, and Finland. At the same time, there is also the ongoing debate about the effects of RETs on the economy, with some commentators suggesting that RETs undermine economic growth since policies impose costs on the private sector (Busch *et al.*, 2013; Alesina *et al.*, 2014; Silva *et al.*, 2012; Darwall, 2015). As such, the two elements (iii), 'EURO*gdppc', and (iv), 'GDPPC*gdpg', could hint at an inverse relationship, i.e. expansive RETs do have an adverse effect on the economy. However, this argument does not hold when considering the other causal paths identified by the analysis. A case in point is that both a low and a high GDP per capita are identified as difference-makers in conjunction with membership of the Eurozone. Consequently, the argument that renewable energy may also decrease GDP per capita (Silva *et al.*, 2012) appears questionable.

2.8 Conclusion

The analysis depicted an ambivalent picture of the role of economic development in RETs in Europe. Crucially, the causal paths identified across the four strongest models reaffirmed that high income states show a strong progress in renewable energy transitions (euro*GDPPC, GDPPC*gdpg), yet invalidated our hypothesis that low income states are too poor to be green (EURO*gdppc). The fourth causal path that we identified, of a low government deficit and high government debt as cause for strong progress in renewable energy transitions (def*DEB) could mean that a more favourable investment environment prior to the introduction of austerity drove a strong progress in renewable energy transitions. In turn, however, this finding leads to the question whether current policies under an austerity regime will be sufficient to drive renewable growth in the future; something that calls for in-depth research on the effects of the economic crisis on contemporary renewable energy policy.

Overall, the results of the calibration showed that 75 percent of EU member states showed strong progress in expanding their renewable electricity share between 2008 and 2013, including most of the debt-ridden states (with the exception of Cyprus), as well as several states with low real GDP growth/ GDP per capita. As such, and considering the identified causal paths, no growing division between high and low income EU countries could yet be identified. As differing conditions of means seem to explain a strong RET equally well, other factors, for example within the national political context, may be playing a role in driving the expansion of renewable energy. This outcome is supported by the fact that Eurozone membership was identified as a difference-maker in opposite income contexts.

Concerning the debate on 'sustainability as a luxury', the analysis demonstrated that of the three factors crucial to sustainability – motivation, willingness and means – the role of means remains ambiguous. Indeed, the result of the QCA analysis suggests that RETs are promoted both because of, and in spite of, the means. Here, the power of the binding Europe 2020 targets in encouraging countries to ensure the expansion of renewable energy despite potential economic reservations should not be underestimated. By establishing a target framework across EU member states, the 2020 Strategy provided a common driver for the expansion of renewables. It remains to be seen whether more significant divisions in reaching the targets will emerge over time. However, for the time being, our analysis indicates that 'where there is a will, there is a way'.

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Chapter 3: Turning Cuts into Growth: German and British Renewable Energy and Climate Policy during the Economic Crisis and Austerity

3.1 Preface

The EU is considered, and considers itself, a global green pioneer (Kilian and Elgström, 2010). This ambition is sustained by the commitment and actions of two of its most influential member states: Germany and the UK. Both countries are important players in driving global climate mitigation (Börzel, 2002; Carter, 2014), and have implemented ambitious renewable energy and emission targets under the Europe 2020 Strategy. Yet, Germany and the UK were also important advocates of austerity during the European Debt Crisis.

Within the framework of the thesis, this chapter represents the first in-depth (small-n) analysis addressing the complex interplay of economic conditions, cost factors associated with climate action, and the commitment of countries to continue their renewable energy transitions in times of economic crisis and austerity. The chapter fundamentally follows the main research question of the thesis by seeking to identify the how renewable energy transitions fared in Germany and the UK during the economic crisis and austerity. Yet as part of an edited volume that focuses on climate policy more generally, the analysis also includes related climate frameworks in addition to renewable policies.

The comparative study of Germany and the UK is particularly driven by important differences in the success of their renewable energy transitions (due to distinct underlying strategies of each country's energy and climate policy), and varying structures of their economies that were differently affected by the economic crisis and austerity. These contextual particularities allow for the analysis to go beyond a general statement on whether austerity influenced renewables. In fact this chapter also focuses on the varying ways in which differently implemented austerity measures affected differing renewable energy policy instruments under distinct economic and political conditions.

The chapter is written in the style of a contribution for an edited volume to be published by the Oxford University Press. The book seeks to provide a comprehensive analysis of the effects of the economic crisis and austerity by analysing policy change at the supranational and national level, and across environmental policy areas. It thereby follows three main questions revolving around the identification of policy change, the kind of policy change, and the underlying strategy in the implementation of policy change. This chapter thereby contributes to the aims of the volume by addressing renewable energy and climate policies in the two largest economics and emitters of greenhouse gas emissions in the EU.

Central to the edited volume is the application and further development of the Index of Policy Activity (IPA) as developed by Schaffrin *et al.* (2015). The index seeks to provide a comparative measure of climate policy output. By focusing on the density (number of policies) and intensity (content of policies) the IPA follows Howlett and Cashore's (2009) taxonomy of policy elements and focuses on six dimensions, or measures, of policy output: objectives, scope, integration, budget, implementation, and monitoring. 'Objectives' refer to the targets and goals a policy seeks to achieve. The 'scope' of a policy is determined by the target groups it covers. Policy 'integration' depends on the role a policy plays within the wider policy framework; as a standalone policy, part of a package, or as a complementary measure. The 'budget' measure addresses the financial means associated with a policy, either through direct funding or costs imposed on societal groups. While financial support is crucial for the effectiveness of policies to achieve their objectives, this measure is likely to be impacted by the effects of economic crisis and austerity. 'Implementation' refers to the way in which a policy is put into practice, while 'monitoring' identifies whether there is a system in place to ascertain if a policy fulfils its goals. Each of the six indicators has a coding scheme and calibration mechanism and contributes to the final IPA score of a policy in equal measure.

The analysis first establishes the differing economic backgrounds of Germany and the UK, and provides a comprehensive analysis of the energy and climate policy paths chosen prior and during the crisis. The chapter then applies the IPA's six measures to a set of energy and climate policies relevant to the reaching of the 2020 targets in Germany and the UK. The analysis includes policies that cover (i) renewable electricity generation (the German Renewable Energies Law (EEG); the UK's Renewables Obligation (RO), Micro-FiT, and Contract for Difference (CfD)), (ii) renewable heat programmes (German Market Incentive Programme and UK Renewable Heat Incentive), and (iii) emission reduction targets (integrated in the German EEG and NREAP, and part of the UK NREAP and Climate Change Act). In addition, the chapter also assesses (iv) climate taxes (German Eco-Tax and UK Climate Change Levy), as these instruments raise energy costs and therefore represent policies potentially impacted by the effects of economic recession and fiscal consolidation measures.

The analysis determines the specific implications of austerity on these different policy instruments by outlining the evolution of policy costs, and identifying policy-actions under austerity that influence renewable energy transitions and climate action. The analysis thereby also sheds light into the differing ways in which austerity affected the distinct policy pathways and underlying renewable strategies of Germany and the UK. The chapter further contextualises the effects of austerity with the differing economic backgrounds of each case, and thereby provides an important contribution to the ongoing debate on the influence of the economy, and austerity, on energy and climate policy. The results of the IPA show no clear negative trend in the policy intensity over the course of the economic crisis. However, considering the financial factors and development of energy and climate policies in more detail, both countries depict an increasing concern with the cost of its renewable energy transition. Regarding the implemented policy adjustments, the analysis identifies a more severe effect of austerity on renewables in the UK than in Germany.

The chapter also provides several methodological contributions by expanding the standard calibration of the IPA to allow for an improved capturing of the complexities of energy and climate policies. Furthermore, the analysis singles out the 'budget' measure of the IPA to provide an in-depth assessment of policy costs. It thereby showcases the variability that the IPA allows for in its application. As such, the chapter highlights both the potentials and the shortcomings of the IPA in establishing a comprehensive picture of the intricate structures of energy and climate policies. As the first analysis applying the IPA in this context, the chapter establishes the distinct policy adjustments in Germany and the UK in the wake of the economic crisis and austerity that visibly sought to enable the expansion of renewables without over-burdening consumers, or public finances. The analysis thereby stresses the significance of economic factors and the cost of renewables for energy and climate policies. It also hints at the fundamental importance of the 2020 targets in preventing more significant policy changes that would undermine the expansion of renewables in favour of lessening the financial burden of contemporary climate action.

The chapter's results showcase the complexity of this project by highlighting the multiple facets of both austerity policies, and renewable energy transitions. By providing a differentiated perspective, the analysis fulfils the four central aims of the thesis (i-iv) in terms of expanding our knowledge on driving forces and obstacles of renewables (i), the role of economic development (ii) and austerity (iii), and by also addressing influential factors to achieve successful renewable energy transitions (iv).

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Turning Cuts into Growth: German and British Renewable Energy and Climate Policy during the Economic Crisis and Austerity

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3.3 Introduction

As the two largest economies and emitters of greenhouse gases (GHG) in the EU, Germany and the UK have played influential roles in European climate change action (Hatch, 2007; Cass, 2007; Bals *et al.*, 2013; Wurzel *et al.*, 2017). Since 2009/2010, both countries are bound to reach renewable energy and emission targets in accordance with their respective National Renewable Energy Action Plans (NREAP) as part of the Europe 2020 Strategy (European Commission, 2010). However, following the unfolding of the global financial and economic crisis in 2008 and subsequent stimulus packages aimed at reducing a more severe economic recession, Germany and the UK embarked on strict austerity programmes (Bundesfinanzministerium, 2012; HM Government, 2010a). Austerity is part of the neoliberal economic approach that has dominated Western policies over the past decades (Pierson, 2001; Streeck and Mertens, 2010). Its tenets are embedded in the EU's 'Stability and Growth Pact' that ensures sound public finances of the EU member-states and coordinates their fiscal policies by requiring a governmental deficit of less than 3% of GDP, and a government debt not exceeding 60% of GD Fiscal consolidation measures as part of austerity include raising of tax levels to increase revenues and cutting of government budgets to reduce expenditures (Alesina *et al.*, 2014).

This chapter therefore analyses how energy and climate action fared in Germany and the UK under the 2020 targets in times of economic crisis and financial hardship Renewable energy transitions and climate action have often been considered expensive and are therefore vulnerable to shifts in policy priorities due to constrained government budgets and economic recession (Slominski, 2016). Hence, considering the significant implications of austerity on society and government-funded programmes (Gool and Pearson, 2014; McGrath *et al.*, 2015; Hannon, 2013; McKee *et al.*, 2012; Karanikolos *et al.*, 2013; Mckay, 2012; National Children's Bureau, 2012), the chapter seeks to answer the question whether austerity measures also negatively affected renewable energy and climate policy in Germany and the UK.

There are some important commonalities between the two case studies in the light of their influential role in European climate action, as well as their shared 2020 targets and ambition to reduce government debt levels under the auspices of austerity. However, this comparative study is primarily driven by crucial differences in the role that the two countries assign to renewables as part of their climate action, the regulatory framework they employ to support them, and the structures of their economies that were differently affected by the economic crisis and austerity. The chapter therefore analyses how austerity impacted these divergent underlying policy strategies. As this chapter represents the first analysis of its kind, it provides a valuable contribution to our knowledge on energy and climate policy in Germany and the UK during times of crisis and austerity. It further provides insight into the importance of the economy for renewable energy transitions and climate action. Due to the difference in each country's policy framework, it does so also in light of the effects of austerity on different policy instruments.

The chapter's analysis is divided into two main parts. It first employs Schaffrin *et al.*'s (2015) Index of Policy Activity (IPA) that allows for comparison of each country's specific policy performance over time. The analysis thereby seeks to identify whether German and UK energy and climate policies that are essential to reaching their 2020 targets have changed since the implementation of austerity in 2009/2010. To do so, the chapter analyses key energy and climate policies in Germany and the UK that were established in both countries since 1999. The timeframe of approximately 15 years of policy evolution (1999-2015) enables the identification of a potential policy change in the wake of the economic crisis and austerity. The choice in policy instruments follows the aims of the 2020 Strategy as differentiated in the National Renewable Energy Action Plans (NREAPs), excluding transport. The chapter also discusses taxation instruments which were potentially targeted under austerity.[10] The analysis comprises key renewable electricity schemes (German Renewable Energies Law (EEG); UK's Renewables Obligation (RO), the Contract for Difference (CfD), and Micro-FiT Scheme), climate and energy taxes (German Eco-Tax; UK Climate Change Levy), renewable heat programmes (German Market Incentive Programme; UK Renewable Heat Incentive), and important renewable and emission target frameworks (NREAP of Germany and the UK, and the UK's Climate Change Act). The overall score of the IPA consists of six measures that assess the objectives, scope, integration, budget, implementation, and monitoring of climate policies. Jointly, they determine the intensity of a policy and its amendments.

In the second part of the analysis, the chapter focuses on only the 'budget' measure of the IPA, and contextualises the findings through a brief policy analysis. The 'budget' dimension of the policies plays an important role, as austerity is concerned with government expenditures and revenues, and since the increase of electricity costs represents a major concern in times of economic recession (He *et al.*, 2015; Slominski, 2016; Skovgaard, 2014). This indicator is established based on both the direct government finances associated with funding a certain climate policy, and the financial burden that a policy exerts to societal groups, its so-called 'imposition' (Schaffrin *et al.*, 2015). The chapter thereby is able to determine whether there have been policy adjustments that altered the 'budget' of climate policies in terms of reducing their funding, or limiting their cost on consumers. The assessment of the indicators is complemented by a brief policy analysis of important austerity-related developments affecting each country's energy and climate policy. The singling out of a particular indicator for analysis showcases the versatility in the application of the IPA. Although it was developed to measure overall policy intensity, the possibility to separately analyse each of the IPA's six measures represents an important advantage for analyses that seek to determine a particular dimension of policies.

[10] Due to this focus and scope limitations, lignite subsidies in Germany, the carbon floor in the UK and similar policies that have significant implications for each country's CO2 emission trends are not included in the analysis.

The Chapter begins by providing a brief background on the objectives and functioning of renewable policies in Germany and the UK, and each country's austerity path. The type and effects of the fiscal consolidation policies are an important contextual factor for the later analysis, as they provide a basic sense of the budget cuts and financial implications for the public sector. The subsequent methodology section explains the particularities of the IPA application in the context of this analysis. The results of the IPA are analysed with a focus on the 'budget' indicator and associated austerity measures, before discussing the overall findings. The analysis reveals a mixed picture in terms of change in the intensity of renewable energy and climate policies over the course of the crisis and austerity. The subsequent, evaluation of the 'budget' indicator, complemented by the policy analysis, highlights distinct adjustments related to an increasingly cost-focused policy approach that may have repercussions on the effectiveness of future climate action in Germany and the UK. The chapter hence stresses the evident balancing act of these policy adjustments to accommodate each country's debt targets and address issues of rising costs of energy while maintaining incentives for renewables in order to reach the 2020 targets. It thereby depicts the importance of such targets in preventing a potentially more significant policy change in light of mounting economic and financial pressures.

3.4 Background

3.4.1 Germany

Germany's revolutionary *Energiewende* – or 'energy transition' – has its origin in a growing environmental consciousness paired with a strong anti-nuclear movement, and a growing commercial motivation of domestic industries that benefitted from the engineering and manufacturing of renewable energy technologies (Geels *et al.*, 2016). Since the emergence of several gas disputes with Russia in the mid-2000s, and considering Russia supplies between 50 and 75% of German natural gas (Eurostat, 2017b), issues of energy security are also increasingly motivating the expansion of indigenous renewable energy sources – at least at an EU level (European Commission, 2014). The planned complete nuclear phase-out following the 2011 Fukushima disaster created an additional impetus driving the *Energiewende* (Bundesministerium für Wirtschaft und Energie (BMWi), 2015a).

Ten years after its first premium-feed-in tariff (FiT) system of 1990, Germany introduced the Renewable Energies Law (*Erneuerbare Energien Gesetz,* EEG) in 2000. The EEG provided a premium payment for renewable electricity on top of the wholesale electricity price. Initially, this premium was fixed and frequently updated and adjusted, and differed according to the renewable technology in question. The premium was paid for by a surcharge added to consumer electricity bills. Since 2012, as part of the 'market integration model', generators have also been able to choose a sliding-FiT that is updated continuously based on the difference between technology-specific market prices and a set reference tariff level (Mayer and Burger, 2014; Bundesministerium für Wirtschaft und Energie (BMWi), 2015c). Through ensured premium payments, the EEG provided investment security for developers and benefitted particularly a growing German renewables industry. The 2014 EEG amendment replaced the premium-FiT system with tenders and renewable auctions, effective from 2017 onwards (Bundesministerium für Wirtschaft und Energie, 2014).

Additionally, Germany has also been imposing an Electricity Tax (*Stromsteuer*), commonly referred to as the Eco-Tax (*Ökosteuer*), on the consumption of electricity since 1999 (Bundesministerium für Justiz und Vebraucherschutz, 1999). The 2000 Market Incentive Programme (*Marktanreizprogramm*) targets the promotion of renewable heat (Bundesministerium für Wirtschaft und Energie (BMWi), 2015d). In 2010, the German government introduced its National Renewable Energy Action Plan (NREAP) as part of its obligations under the 2009 Renewable Energy Directive and the Europe 2020 Strategy. The Plan outlines that the 2009 target of an 18% renewable share in final energy (10.5% in 2010) was to be a renewable electricity share target of 35% in 2020 (17.4% in 2010), and a 40% emission reduction compared to 1990 levels (Bundesregierung, 2010). These targets were embedded in the EEG, and have since been extended to a 60% renewables share in final energy (80% in electricity) and an 80-95% emission reduction compared to 1990 levels by 2050 (Bundesministerium für Wirtschaft und Energie (BMWi), 2015e).

In the wake of the financial and economic crisis, Germany, as a Eurozone member, constitutionalised a ‘debt brake’, followed by what was called a “sustainable, growth-oriented course of consolidation as soon as the financial market and economic crisis had been overcome” (Bundesfinanzministerium, 2012, 8). The debt brake capped the maximum structural net borrowing at 0.35% of GDP and prohibited debt at the *Länder* level after a transitional period (Bundesbank and Deutsche Bundesbank, 2011). The EU’s convergence criteria stand in relation to GDP, thus the potentially negative impact of fiscal consolidation measures on GDP growth can directly undermine the reaching of austerity targets (Alesina *et al.*, 2014). Nevertheless, with government revenues growing faster than spending, the German budget has been running a gradually increasing surplus since 2014, reaching 0.8% in 2016 (Eurostat, 2017a; Destatis, 2017). As such, the overall government debt to GDP ratio peaked in 2012, with a subsequent steady decline (Bundesministerium der Finanzen, 2016; Eurostat, 2017a). Essential for achieving a balanced budget in 2014 for the first time since 1969 was the country’s significant account surplus that reached almost 7.3% of GDP that year, fuelled by a vast export sector, making up approximately 45% of German GDP (World Bank, 2017a).

3.4.2 The UK

The goal of British energy policy has primarily been the reduction of emissions, not the advance of renewables, which are considered one of many low-carbon alternatives (Bowen and Rydge, 2011). Indeed, as Norway provides the bulk of UK natural gas imports, it is considered an effective low-emission ‘bridge-fuel’ that can provide immediate relief from rising carbon emissions, and also help overcome issues of intermittency related to wind and solar power (Eurostat, 2017a; Geels *et al.*, 2016). Also, political opposition towards nuclear power in the UK has materialised far less than in Germany, and in the absence of a significant domestic renewables industry, the expansion of renewables was not regarded as creating significant economic gains vis-à-vis rising energy costs (House of Lords Select Committee on Economic Affairs, 2008). British renewable policy was, therefore, integrated into the liberalised electricity market. By allowing the market to set prices, a core purpose of the policy was to prevent upward pressures on electricity prices and to ensure the economic viability of each implemented renewable project. Lacking a similarly secure investment environment as in Germany, renewables in the UK did not develop as rapidly in the early 2000s (Eurostat, 2017a).

Support for renewables emerged initially as a side-effect, as the UK introduced a Non-Fossil Fuel Obligation (NFFO) in 1990 that was targeted at driving state-owned nuclear energy within the newly liberalised British electricity market, yet later extended to renewables (Haas *et al.*, 2011). In 2000, the UK introduced the Renewables Obligation (RO) that, like the NFFO, continued to operate in a competition-driven electricity market, with only a "philosophical shift to using regulation to deliver wider public policy objectives" (Darwall, 2015, iii). The UK's RO is a Renewable Portfolio Standard that places an obligation onto utilities to buy a set share of electricity from renewables, and is combined with the free-market trading of Renewable Obligation Certificates (ROC). While certificates are assigned per unit of renewable electricity output, their cost (represented in the buy-out price that a supplier has to pay in case he fails to meet the obligation target) remains based on the wholesale market price (Ofgem, 2016).

In 2001, the UK also introduced the Climate Change Levy that applies to all energy consumers except for domestic and transport sectors. Furthermore, the UK's Climate Change Act of 2008 introduced specific carbon limits – 'carbon budgets' - that decrease gradually from 3,018 million tons of carbon dioxide equivalent ($MtCO^2e$) over the first carbon budget period (2008 to 2012) to 1,725 MtCO2e over the fifth carbon budget period (2028 to 2032) (HM Government, 2009, 2016). Through the 2009 Renewables Directive, the UK set ambitious targets of a 15% renewable share in final energy by 2020 (3.7% in 2010) that were specified through its NREAP to include a 31% renewable electricity share target (10% in 2010) (HM Government, 2010b). This new target framework increased the emphasis of British energy policy on renewables, with the 2009 RO amendment introducing certificate banding (Wood and Dow, 2011). The new banding reflected differences in technology costs and economic viability by assigning, for example, two ROCs for solar and offshore wind. Previously, one ROC was assigned per unit of electricity (MWh) regardless of the renewable technology. The RO was further complemented with a Micro-FiT system in 2010 and the Renewable Heat Incentive in 2011. The Contract for Difference (CfD) system was introduced in 2014 to replace the RO.[11] The CfD follows a so-called strike price. If the wholesale price remains below this strike price, the difference is paid to the generator, or, if the wholesale price exceeds the strike price, it is paid by the generator. The incurred costs of the system are transferred onto electricity suppliers through a Supplier Obligation levy and assumed to be passed on to end-consumers (UK Parliament, 2014)

The UK is not a member of the Eurozone, and is therefore not obliged to adhere to the convergence criteria. Nevertheless, the UK implemented the 2010 Fiscal Responsibility Act seeking to limit public sector net borrowing over the coming years. The 1997 Code of Fiscal Stability had been temporarily suspended to allow for a range of stimulus packages in the immediate aftermath of the financial crash (HM Government, 2010a, sec.1). The change in government in May 2010 led to further reductions in public expenditure and tax increases in an emergency budget in June 2010 (Sawyer, 2012). However, unlike Germany, the UK could not benefit from a strong manufacturing and export sector driving economic growth[12] (Rhodes, 2015). Instead, the British economy's dependence on the finance and service sector meant the country was hit much harder by the financial crisis and the subsequent credit crunch than other European economies (Hodson and Mabbett, 2009; Tyler, 2015). Overall, although revenues increased from 2009, government expenditures varied significantly (Eurostat, 2017a; Office for National Statistics, 2016). While the government deficit was steadily reduced from 10.7% in 2009 to 3.0% in 2016, the slow rate in reduction paired with stimulus packages in 2009 led to a growing government debt from less than 60% of GDP in 2008 to almost 90% in 2016 (Eurostat, 2017a; Office for National Statistics, 2016).

[11] Officially motivated by rising costs of the RO, the CfD also allowed for nuclear power to be financed under its scheme, something the RO did not allow for.
[12] The manufacturing sector made up only 10% of GDP in 2013, compared to 24% in Germany (Rhodes, 2015).

Originally set to end in 2015/16, the limited success of the fiscal consolidation measures in reducing deficit and debt levels led to an extension of austerity until at least 2018/19.

To summarise, while Germany has focused on incentivising the expansion of renewable energy, the UK's approach revolved first and foremost around reducing emissions. These differing strategies are reflected in distinct regulatory frameworks: an FiT-scheme aimed at driving a fast expansion of renewables in Germany, and a more market-based approach in the UK, seeking to achieve a cost-efficient, low-emission energy system (Geels *et al.*, 2016). In addition, due to different economic backgrounds, Germany was able to emerge from the crisis with a balanced budget, while the UK continues its path of austerity due to rising government debt.

3.5 Methodology

This chapter employs the IPA as developed by Schaffrin *et al.* (2015) by applying its six policy intensity measures (objectives, scope, integration, implementation, monitoring, and budget) to key renewable energy and climate policies in Germany and the UK. These measures serve as an indicator of the performance of a state in a policy field and provide the basis for comparison. Seeking to gain a comprehensive picture of the renewable energy and climate policy developments in Germany and the UK during the crisis, the analysis focuses on the three key areas of the Europe 2020 energy targets. I therefore assess policies that cover (i) renewable electricity generation (the German EEG and UK RO), (ii) renewable heat (the German Market Incentive Programme and UK Renewable Heat Incentive), and (iii) emission reduction (integrated in the German EEG and NREAP, and part of the UK NREAP and Climate Change Act). In addition, the analysis also includes (iv) direct fiscal instruments (the German Eco-Tax and UK Climate Change Levy) that aim to increase the cost of electricity to incentivise greater energy efficiency, as they have a direct effect on the cost of energy as well as government revenues. They are therefore considered potentially important factors in the light of the effects of the economic crisis and austerity. My analysis focuses on the evolution of each policy from its conception until the most recent amendments, and thereby covers a time frame from 1999 until 2015.

For each policy intensity measure, I generally apply the standard calibration mechanism as outlined in Schaffrin *et al.* (2015), to enable comparability with other IPA applications in this volume. Where needed, due to available data or policy design, the mechanism was expanded closely in line with the standard calibration approach. The following outlines the standard approach and any expansions of it applied in this analysis. Regarding each of the six indicators in turn, for the 'objectives' measure, scores follow the respective target's ambitiousness relative to the IPCC's benchmark target of 80% emission reduction by 2050 (based on 1990 levels) or a 100% renewable energy production. Targets aimed at any given year before 2050 are evaluated under a steady growth trajectory based on the initial set target. For each target subcategory the score of 1.0 represents that the policy's target is in line with the IPCC's benchmark. The final objectives score is the highest of the two subcategories of emissions and renewable energy, as per the standard IPA application (Schaffrin *et al.*, 2015).

'Scope' is assigned scores in the light of included target groups such as companies and households, as well as covering both demand and supply, and on the number of energy sources included. Each target group adds a score of 0.16, while each energy technology (oil, gas, coal, wind, solar, biomass, hydro, CHP, others) provides a score of 0.05. 'Integration' includes the wider policy framework, ranked higher as part of a package (1.0), or in reference to another policy (0.5) rather than as a stand-alone policy (0.0). 'Implementation' focuses on the number of actors and type of implementation procedure, with each category receiving a maximum 0.5 score, if the implementation process is transferred to one specific actor, and the rules of implementation are pre-set and unable to be changed without political action. 'Monitoring' receives scores of 0.5 for, firstly, including a monitoring procedure for the policy and, secondly, having a distinct, impartial agency assigned for the task.

Finally, the 'budget' measure is composed of 'expenditures', the direct funding a policy receives, and the 'imposition', i.e. the costs transferred onto societal groups. As per the standard calibration, expenditures are rated in relation to the overall expenditures on energy and fuels of the respective government (Schaffrin *et al.*, 2015), with data being drawn from Eurostat (2017a). The imposition factor of the 'budget' measures is evaluated relative to the financial burden imposed by the value-added tax (VAT). The VAT is "the most universal tax and [is] widely applied for comparative research" (Schaffrin *et al.*, 2015, 13). It serves as an analytical anchor for policy costs relative to other financial burdens imposed by the government. The specific 'budget' analysis thereby allows for the identification of the cost of climate action vis-à-vis other government-induced costs in a national context, and compared to other countries.[13]

The Chapter singles out the 'budget' measure from the overall IPA at a later point in the analysis to highlight whether austerity had an impact on the financial intensity of policies. I can thereby also identify potentially differing impacts of austerity on diverging climate policy approaches between Germany and the UK. It is important to note that the German Renewable Energies Law (EEG) and the UK Renewables Obligation (RO)[14] are not directly financed by government expenditures. Instead, in Germany their costs are transferred onto consumers via the EEG-surcharge. In the UK, the costs are recovered from consumers by multiplying the expected buy-out price for Renewable Obligation Certificates by the obligation percentage. As the analysis is concerned with the actual costs of the policies, irrespective of the way in which the financial support is generated, renewable energy policies are assessed in light of this imposition on consumers. This approach is not part of the standard IPA, which normally does not include money coming from consumers. However, the cost of policies imposed on consumers is an important indicator of the actual cost of a policy instrument, and is therefore a crucial aspect of the intensity of a policy. In light of the aims of this

[13] VAT as a reference point is used for comparability reasons across this volume, yet, as will be shown in the later analysis, does not serve well as a comparative approach between Germany and the UK, due to significant differences in the respective VAT rates.

[14] The 'budget' measure analysis does not include the Contract for Difference, since there is no data available on its expenditures or incurred costs.

chapter, the importance of financial aspects of a policy become all the more significant. In applying this approach, this analysis overcomes a potential blind-spot of the standard IPA application in addressing the full 'budget' of renewable energy policies.

The 'imposition' of the EEG and RO is calculated in relation to the average end-consumer's electricity price. Each policy's cost per kWh is therefore compared to the burden of the VAT on electricity per kWh for a medium sized household (3,500kWh in Germany and 3,800kWh in the UK). In Germany, the cost of the EEG is generated using the official surcharge set by the transmission grid operator in proportion to the VAT cost on electricity for each respective year, as VAT rates for electricity were altered during the timeframe of analysis. For the UK, the calculation of the cost of the RO is slightly more complex, but is carried out in line with the official approach by taking the yearly obligation level on the one hand and the buy-out price of the ROC on the other hand. The applied obligation levels are for England, Wales and Scotland, excluding Northern Ireland, which has different targets. Similarly, the imposition scores for the German Eco-Tax and British Climate Change Levy are calculated relative to the respective VAT costs. Other policies, such as the British Climate Change Act and both countries' NREAPs have neither an associated expenditure nor an imposition and therefore do not receive a budget score. Due to the lack of comprehensive financial data on the German Market Incentive Programme, and the UK Heat Incentive and Contract for Difference, no detailed 'budget' calculations are made about them.

3.6 The IPA Application

The analysis begins with an overall picture of the evolution of the selected climate and renewable policies in Germany and the UK, before taking a closer look at only the 'budget' measure of the IPA. This section therefore first embarks on the analysis of the overall IPA that is the result of all six IPA measures that have been calculated according to the outlined methodology. The overall IPA score for each policy also includes the 'budget' measure and the respective imposition scores generated for the German EEG and the UK RO that will be assessed in greater detail in section 4.1. The overall results of the six measures for each policy in Germany and the UK per year of implementation and amendment are depicted in Table 1, in chronological order per policy, beginning with the central renewable policy, followed by the tax, the renewable heat policy, and general target frameworks.

Table 4: Overall Scores for the Index of Climate Policy Activity of Key Renewable Energy Policies in Germany and the UK, 1999-2015. Each year marks the introduction or amendment of a policy with shades of grey marking the continuation of a respective policy

Germany			**United Kingdom**		
Year	Policy	IPA	Year	Policy	IPA
2000	Renewable Energies Act (EEG)	0.71	2000	Renewables Obligation	0.63
2004		0.65	2002		0.52
2007		0.62	2005		0.48
2009		0.66	2006		0.48
2012		0.73	2007		0.49
2014		0.75	2008		0.49
			2009		0.51
			2010	Micro-FiT	0.30
			2014	Contract for Difference	0.30
1999	Eco-Tax/ Electricity Tax	0.43	2001	Climate Change Levy	0.51
2000		0.49	2002		0.59
2001		0.51	2004		0.58
2003		0.52	2005		0.56
2004		0.51	2007		0.54
2006		0.57	2008		0.53
			2010		0.55
2000	Market Incentive Programme	0.61	2011	Renewable Heat Incentive	0.33
2007		0.68	2014		0.33
2009		0.77			
2015		0.93	2008	Climate Change Act 2008 - Overall	0.75
2010	National Renewable Energy Action Plan	0.72	2010	National Renewable Energy Action Plan	0.72

Considering the results as a whole, the German IPA scores are generally higher, reflecting a greater policy intensity than their UK counterparts. This pattern applies particularly to each country's central policy for the expansion of renewables in electricity generation – the German EEG and the British RO – as well as the renewable heat policies. The German Eco-Tax and British Climate Change Levy achieved largely similar scores, however considering the fact that no policy changes took place since 2006 for the Eco-Tax and 2010 for the Climate Change Levy, a more detailed look at their development during the crisis will be taken in the 'budget' sub-section (3.6.1). Germany and the UK also show closely shared levels of ambition in their 2010 NREAP scores. With no separate German policy equivalent to the British Climate Change Act direct comparison is not possible, yet the overall high score of Climate Change Act of 0.75 should be noted.

It is also important to recognise that the framework of the UK's renewable and climate policy is different from the German approach. Germany's EEG includes the trajectories for renewable and emission targets, and covers different project sizes and technologies. Also, for example, the gradually rising IPA score for the German Market Incentive Programme is due to an increased number of target groups and technologies ('scope'), and more ambitious 'objectives' since 2009. In contrast, the UK's policy framework is more fragmented, which affects the 'objectives' and 'scope' measures, leading to an overall lower IPA score of UK policies. The country's emission and renewable target trajectories are outlined in the separate Climate Change Act and NREAP, while the RO's shortcomings in 'scope' were complemented through the 2010 Micro-Fit. The RO, the Micro-FiT, and the Climate Change Act and NREAP should therefore be seen as being somewhat complementary. The same applies for the Renewable Heat Incentive that crucially supports the fulfilment of the targets laid out in the Climate Change Act. Like the RO, the Contract for Difference's (CfD) score suffers from a limited 'scope' and 'objectives', but also lacks data on its 'budget' measure thereby significantly reducing its score further.

In addition, important, yet technical, improvements of the RO in the 2009 amendment that introduced certificate banding had not effect on the IPA score. This is due to the fact that the adjustments did not expand the 'scope' but merely altered the system of calculating certificates, meaning the change was not captured by the IPA. This banding was, nevertheless, crucial in making particularly offshore wind more competitive with other, cheaper sources of renewable energy, and reaffirmed the UK as the global leader in offshore wind deployment, reaching over 5GW of installed capacity in 2016 (Geels *et al.*, 2016).

3.6.1 The Cost of Renewable Energy Transitions – The 'Budget' imposition and Austerity

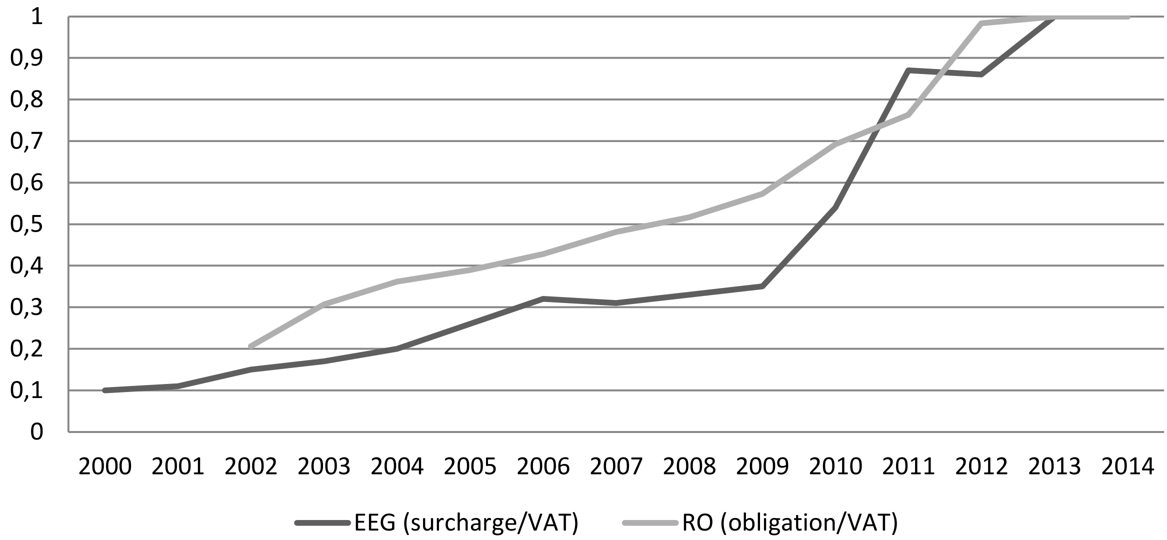
Climate policies are associated with increased energy costs through climate taxes and the transfer of additional costs for the deployment of renewables onto consumers. As the economic crisis and austerity increasingly shifted the focus towards growing economic difficulties and raised concerns over the costs of climate action (Slominski, 2016; Skovgaard, 2014), this section focuses on the development of these cost factors in renewable energy and climate policies during the crisis. It begins by assessing the 'budget' measure of the IPA in terms of the so-called 'imposition' of the key renewable energy policies and climate taxes in Germany and the UK. The findings of the analysis are complemented in 3.6.2 with a brief policy analysis of austerity-related developments affecting climate action in the two countries.

To reiterate, the cost of the German EEG is transferred onto end-consumers through a surcharge (*Umlage*) on the electricity bill. Between 2000 and 2009, this surcharge accounted for between 6.2 and 7.3EURct per kWh, however, it increased significantly to 14.1EURct/kWh by 2014 (Bundesministerium für Wirtschaft und Energie (BMWi), 2015c). This sharp increase was caused firstly, by strong capacity additions in solar photovoltaics and, secondly, as the result of a falling wholesale market price of electricity as consumption levels decreased over the course of the economic crisis (Mayer and Burger, 2014). The difference between the market price and FiT level (represented through the surcharge) therefore widened. This increase of the surcharge for private consumers was reinforced through extensions of industry exemptions. Germany implemented several measures softening the blow of rising energy costs to the manufacturing sector, with the

2012 EEG amendment allowing for exemptions of up to 99% of the EEG surcharge for energy-intensive industries (Jennrich *et al.*, 2014).[15] The extended exemptions, however, meant the costs had to be borne by other, paying customers (i.e. households) (Fichtner, 2016).

The UK's renewable support system has been integrated into the liberalised electricity market in order to constrain the financial impact on consumer electricity prices. The remuneration levels of the ROCs therefore followed the volatility of wholesale market prices. As obligation levels increased from 3% of supply in 2002/03 to 11.1% in 2010/11 and 24.4% in 2014/15, the buy-out price levels[16] increased gradually from GBP30.00/MWh in 2002/3, to GBP36.99/MWh in 2010/11 to GBP43.30/MWh in 2014/15 (Ofgem 2010; Ofgem 2017).

Figure 1: German EEG and UK RO, Imposition Scores as part of the 'budget' measure IPA, 0.0-1.0, 2000-2014



Source: (Bundesverband der Energie- und Wasserwirtschaft, 2016; Bundesministerium für Wirtschaft und Energie (BMWi), 2015b; Ofgem, 2016; Pollit, 2010; UK Government and Department for Business Energy & Industrial Strategy, 2016).

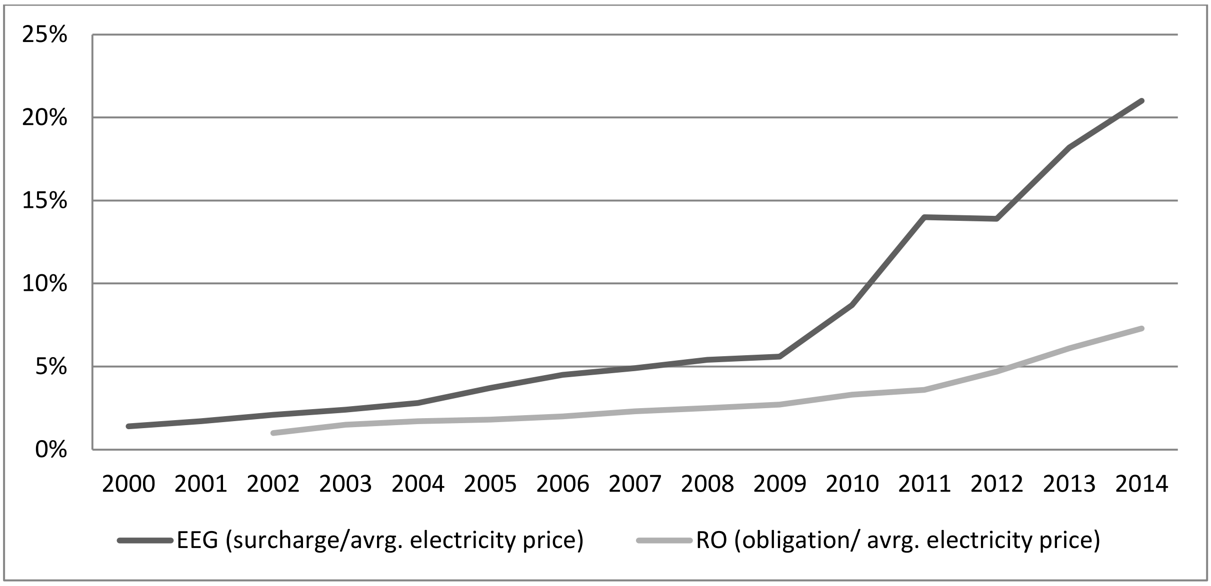
Considering the 'imposition' factor of the 'budget' score of the German EEG vis-à-vis the British RO, it may appear counterintuitive that the cost of the RO relative to the VAT, with one exception (2011), has been continuously higher than the EEG (see Figure 1). The scores, however, do not make

[15] For a more detailed outline and analysis of the 'special balancing regulation' (besondere Ausgleichsregelung) for energy-intensive industries, see Jennrich et al. (2014).

[16]The amount suppliers need to pay for each certificate if they do not meet their obligation.

any statement about whether the UK's RO is costlier than the German EEG. Rather, the 'imposition' identifies that the UK's RO represents a more significant burden on the energy price relative to other added costs (represented by the VAT) than the EEG in Germany – at least until 2011. Indeed, considering the cost of each policy relative to the electricity price, we see the expected picture of a far greater financial burden imposed by the EEG compared to the RO (see Figure 2).

Figure 2: German EEG and UK RO, Policy Cost Share of Average Household Electricity Price, in %, 2000-2014

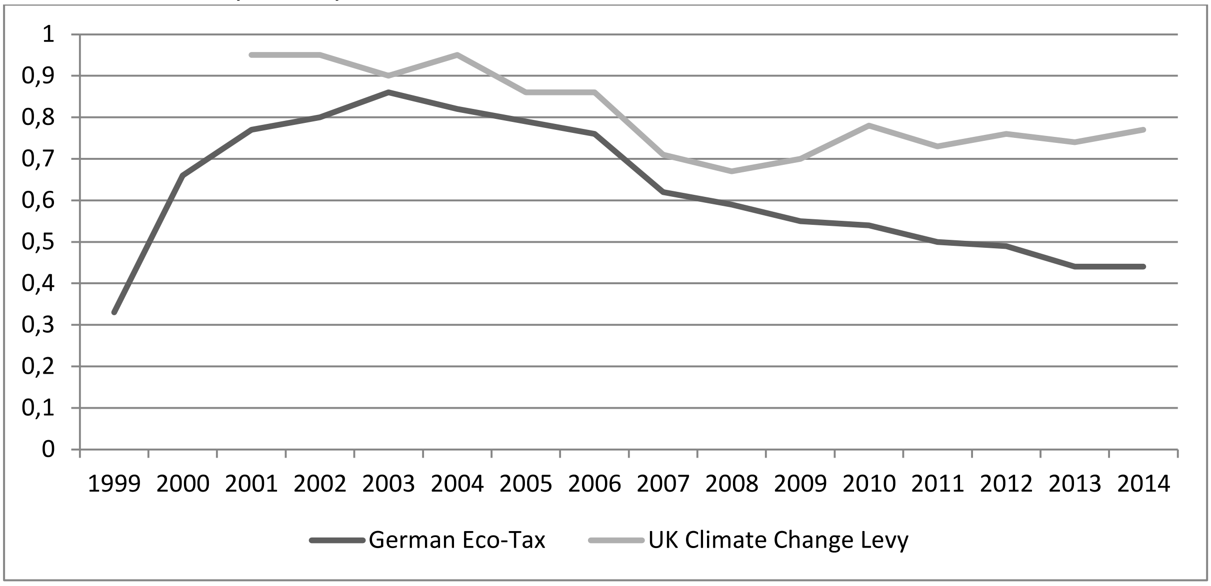


Source: (Bundesverband der Energie- und Wasserwirtschaft, 2016; Bundesministerium für Wirtschaft und Energie (BMWi), 2015b; Ofgem, 2016; Pollit, 2010; UK Government and Department for Business Energy & Industrial Strategy, 2016).

Going back to the 'imposition' score (Figure 1), since 2013, both policies match or exceed the cost posed by VAT. The difference in the scores is crucially impacted by the significantly lower VAT on domestic electricity of just 5% in the UK compared to Germany (16% until 2006, then 19%). As such, the share of the UK's RO costs relative to the mere 5% VAT is greater (and hence receives higher scores) than the share of the cost of the German EEG relative to the significantly higher VAT rate of 16/19%. Indeed, there is a visible shift in the trajectory of the EEG's score following Germany's 2006 VAT rate increase (that therefore lowered the ratio of the cost of the surcharge in proportion to the increased costs of the VAT). This IPA score for the imposition component of the 'budget' measure should therefore been seen as the policy intensity primarily within the national context relative to other government-imposed costs. The actual greater cost of the EEG can be seen in how closely it still tracks the RO's score despite the 11-14 percent points difference in VAT rates.

Both the Eco-Tax and the Climate Change Levy generate direct government revenues and are therefore important measures to consider in light of the austerity programmes introduced during the financial and economic crisis. In Germany, the Eco-Tax was kept at a steady level of 2.05EURct/kWh from 2003, while in the UK, the Climate Change Levy was set to rise annually in line with inflation from 2006 onwards, resulting in an increase from GBPp0.43 between 2001 and 2007 to GBPp0.51/kWh in 2012/13. As a consequence of these measures, the imposition score of the Eco-Tax is seen to gradually decrease, particularly as the VAT rate was increased in 2006. As the Tax was kept at a steady rate, the imposition scores gradually fell during the significant growth in electricity costs and VAT relative to it. The UK's adjusted levy rates after 2006 resulted in a relatively steady score. As above, it is important to again acknowledge the significant difference in VAT rates on electricity. The Levy's higher scores, therefore, represent a greater domestic cost in proportion to the significantly lower VAT rate. In essence, Germany's EEG is the more expensive renewable policy compared to the UK's RO. However, considering other government-imposed costs, the RO has for a long time added a greater financial burden on the electricity price than the EEG.

Figure 3: German Eco-Tax and UK Climate Change Levy, Imposition Scores as part of the 'budget' measure of the IPA, 0.0-1.0, 1999-2014



Source: (Bundesverband der Energie- und Wasserwirtschaft, 2016; Institute for Fiscal Studies, 2014).

3.6.2 Austerity in Renewable Energy and Climate Action

In Germany, the increase in the cost of the energy system concerned the government, despite the success of the country's FiT scheme in expanding renewables capacity. Through the 2014 EEG amendment and effective since 2017, the German government has replaced the EEG's FiT with an auction system that follows a set-out expansion corridor (Bundesnetzagentur, 2017; Deutscher Bundestag and Bundesrat, 2016; Bundesministerium für Wirtschaft und Energie, 2014). This policy change is in line with European Commission recommendations to shift renewable support instruments towards greater "market exposure" (European Commission, 2013, 5) and to provide competitive allocation mechanisms – also driven by the need to reduce energy costs and to get subsidy levels for renewables closer to the actual technology costs.

In terms of austerity, Germany introduced relatively moderate cuts to the federal budget, which has been increasing again since the government achieved a balanced government budget as of the end of 2014 (Bundesministerium der Finanzen, 2015). Throughout these years, German renewable energy and climate policy[17] remained largely untouched. Although 2013 and 2015 saw cuts in certain ministerial budgets[18], overall, financial support increased between 2012 and 2016, particularly for the Federal Ministry for the Economy and Energy (BMWi)[19] (Bundesministerium der Finanzen, 2015).

Table 5: Total Federal Budget and Departmental Allocations to Renewable Energy, 2012-2015

				BMWi			
		BMU	BMEL	Total:	Of Which:		
	Total Federal Budget, EURbn	Climate Protection, EURmn	Sustainability, research and innovation, EURmn	Energy and sustainability, EURmn	Renewables research, (until 2014, energy research) EURmn	Insulation and KfW subsidy/ energy efficiency	Support of singular measures for sustainable energy
2012	311.6			1,675.42	120.9	30.5	
2013	310		178.76	1,597.52	115.14	29.9	
2014	296.5	386.2	188.6	2892.1	158.36	747.5	261.4
2015	306.9	372.13	204.93	2689.91	161.653	686	254.3
2016	316.9	417.9	238.8	2,729.80	313.2	508.2	250

Source: (Bundesministerium der Finanzen 2015)

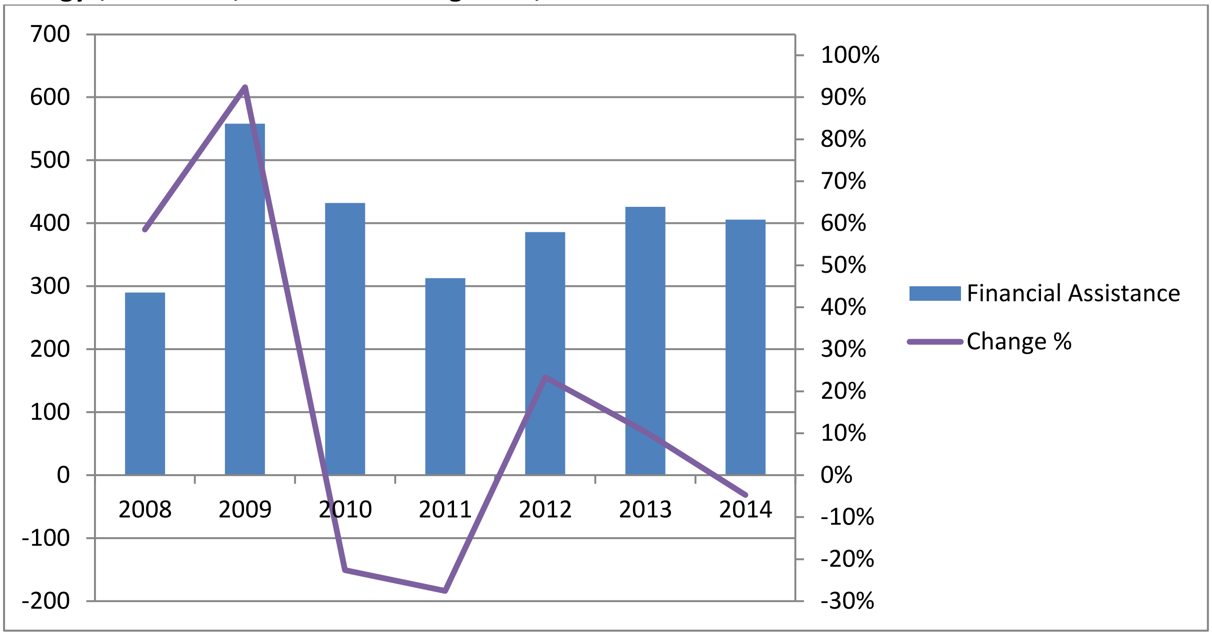
However, the German government began a gradual re-assessment of its subsidy mechanisms as part of its austerity programme (Bundesministerium der Finanzen, 2014). According to the Federal Ministry of Finance (2010, 2012, 2014), direct subsidies of the government in form of financial assistance targeted at energy efficiency and renewable energy increased in 2009 as part of the anti-cyclical finance policy, before seeing falling levels in 2010 and 2011. Both 2012 and 2013 saw levels rise again, with 2014 levels reducing marginally, depicting a gradual stabilisation of subsidies at a higher level of about 400EURmn in 2014 compared to 2008 (approximately 290EURmn), but significantly below 2009 levels (approximately 560EURmn) (Bundesministerium der Finanzen, 2010, 2012, 2014; Bundesregierung, 2015).

[17] Climate projects are run by the Ministry for the Environment (BMU), the Ministry for Food and Agriculture (BMEL) and the Ministry for Economics and Energy (BMWi).

[18] For example, the BMU received a reduced funding of 372EURmn in 2015 for climate protection compared to 386ERUmn in 2014. Initially, the BMWi's budget for Energy and Sustainability was reduced from 1,675EURmn in 2012 to 1,597EURmn in 2013 (Bundesministerium der Finanzen, 2015).

[19] From 1,675.42EURmn in 2012 to 2,729.80EURmn in 2016 (Bundesministerium der Finanzen, 2015).

Figure 4: German Subsidy Development for sub-category "Energy efficiency and renewable energy", in EURmn, and annual change in %, 2008-2014



Source: (Bundesministerium der Finanzen 2010, 2012, 2014; Bundesregierung 2015)

However, a restructuring of the subsidy mechanism affected several renewable energy and climate programmes that are directly dependent on government subsidies, such as the Market Incentive Programme, and other energy efficiency, as well as research and innovation programmes. Their financing structure was reformed in 2011 through the introduction of the *Energie- und Klimafonds* (EKF, Energy and Climate Funds), in a move to reduce the burden of these programmes on public spending. The EKF draws money primarily from the revenues acquired through the European Emission Trading System (ETS). As such, the issues surrounding continuously low emission price levels, particularly after 2011, reduced the available financial means to the EKF, and therefore its effectiveness in providing support for the programs drawing from it (Andor *et al.*, 2015).

In the UK, the binding 2020 renewables targets meant that the UK had to change its previous policy of prioritizing the minimization of cost-effects over the pace of renewables deployment. Crucial policy steps included the certificate banding of the RO in 2009. As the National Audit Office (2010, 3) stated: “data on the overall level and distribution of public funds to support renewable energy technologies is not routinely collected and published”, which prevents the comparative analysis of annual British subsidies for renewable energy and climate programmes at this point. Nevertheless, the Department of Energy and Climate Change (DECC) saw budget cuts for three consecutive years following 2010/11 (UK Parliament, 2014; HM Treasury, 2015a). Further budgetary adjustments followed the 2011 Levy Control Framework (LCF). The LCF established budgetary caps in addition to quantity and price-based policy instruments, effectively “subordinating renewable energy policy to budgetary policy” (Lockwood 2016, 194). An anticipated overspend in 2015 and the parallel announced extension of austerity for another four years, resulted in additional budget cuts of a total of 22% for DECC (now the Department for Business, Energy and Industrial Strategy, BEIS) until 2019 (HM Treasury 2015b).

Several policy adjustments followed in 2015. In order to increase revenues by approximately GBP450mn per year, the July 2015 Budget extended levy charges to renewables and cogeneration that were previously excluded (HM Treasury, 2015c). The rates for Micro-FiT support were adjusted and overall funding capped at GBP100mn up until 2018/19 (HM Treasury, 2015c). This 65% decrease in Micro-FiT rates for residential solar per kWh[20] is expected to decrease the expansion of renewables by approximately 6GW until 2020 and cost a potential 18,700 of a possible 32,000 solar jobs (DECC, 2015). The RO was closed for solar project applications of 5MW and below, as well as for onshore wind power in April 2016, with the latter being closed one year earlier than previously planned (HM Government, 2015).[21] Together with the Micro-FiT changes, these actions were estimated to reduce spending by GBP500-600 million (HM Government, 2015). Further savings are expected to be generated through the axing of the Carbon Capture and Storage programme and the funding reductions for the Renewable Heat Initiative’s by an overall GBP700mn (HM Treasury, 2015b).

[20] From a previous 12.47GBPp/kWh to 4.39GBPp/kWh.
[21] The early ending of the support was also driven by public opposition against onshore windfarms.

3.7 Discussion

The application of the IPA reveals an unclear picture regarding policy intensity trends during the economic crisis and austerity. Indeed, on the German side, the Renewable Energies Act (EEG) and the Market Incentive Programme actually increased in intensity through their latest amendments from 2009 to 2015. On the UK side, few amendments were passed after the introduction of austerity in 2010. The two policy changes the IPA captured in the UK included the 2014 Renewable Heat Incentive that received an unchanged score, and the introduction of the Contract for Difference (CfD). The score of the CfD significantly suffered from the lack of more detailed data on its 'budget', as well as the overall fragmented policy approach that also affected the scores of the Renewables Obligation and the Micro-FiT. To allow for the comparability of the IPA scores across cases, each of the six measures of the IPA is considered in equal shares as part of the final score. However, in the UK's case, this meant that the score of UK renewable policies was dragged down by the fact that they did not provide integrated emission or renewables targets ('objectives'), and were limited in their application to certain technologies, or sizes of renewable energy plants ('scope'). The overall IPA results therefore did not provide a clear indication of whether the low scores of the 2010 Micro-FiT and the 2014 CfD (that further suffered from a lack of financial 'budget' data) were in fact a result of the economic crisis, or rather the methodological approach.

While the fragmented policy approach therefore skews a direct comparison of, for example, the intensity of the RO with the EEG, the scores reflect the less stable and more complicated policy environment of the UK compared to Germany. As such, the UK's convoluted renewable energy framework and market-based policy design did not provide for similar financial certainty as experienced in Germany through the premium-FiT system. The lack of micro-FiTs until 2010 further resulted in the deployment of renewables almost exclusively through large, corporate actors, unlike in Germany, where the steady expansion of renewables was significantly carried by new market entrants (citizens, cooperatives, activists, farmers, municipalities) (Geels *et al.*, 2016).

To also overcome the shortcomings of the overall IPA in identifying a connection between austerity and the IPA scores, I analysed the 'budget' measure for the EEG, RO, and the two climate taxes independently. Unfortunately, the significant difference in VAT rates of 5% (UK) and 16/19% (Germany) aggravated the direct comparability of the results. Nevertheless, the imposition scores reflected the domestic financial burden borne by consumers relative to other government-induced costs, represented through the VAT, and hence showed the willingness of governments to bear the cost of climate action in a national context. Regarding the two taxation instruments, Germany had refrained from increasing the rate of its Eco-Tax since 2003 – possibly to prevent further increases to the financial burden of energy on consumers – visibly through a gradually falling 'imposition' score. In contrast, the UK has increased the rate of the Climate Change Levy annually since 2006, resulting in a steady imposition score that stood above the Eco-Tax. However, at the same time, neither government raised VAT rates on energy to achieve its austerity targets, although Germany had done so in 2005. In light of the differing success in the two countries to achieve their debt targets, these findings might testify to Germany's ability to achieve a balanced government budget primarily through its export sector, thereby not requiring increased revenues through taxation. At the same time, both countries likely refrained from increasing VAT rates on energy due to an already rising financial burden for consumers, visible through the increasing 'imposition' scores of both renewable policies. As such, for the UK that maintained an annually increasing price level of the Levy, the findings could depict the country's steadfastness towards its climate goals, while Germany was increasingly concerned with rising energy costs. However, the decision to extend the levy to renewables and co-generation in 2015 depicts a government seeking to increase revenues rather than to incentivise emission reductions.

Nevertheless, the growing cost of Germany's energy system was indeed an influential factor for the policy changes implemented in the wake of the crisis and austerity. Both scores for the German EEG and the UK's RO increased significantly following the beginning of the economic crisis and the 2020 targets. While these scores, therefore, did not show a visible attempt of either country's government to curtail the growing financial burden of their renewable support, the subsequent analysis depicted the distinct policy adjustments taking place in Germany and the UK that sought to address the financial issues of their climate action vis-à-vis their need to reach the 2020 targets. Considering the central importance of Germany's producing industry for *inter alia* achieving its balanced government budget and thereby austerity targets, the country introduced far-reaching exemptions for the industry on imposed climate costs. As these costs increasingly overburdened paying consumers (i.e. private customers), the 2014 EEG amendment again had to reduce exemptions (Bundesministerium für Wirtschaft und Energie, 2014; Bundesamt fur Wirtschaft und Ausfuhrkontrolle, 2016).

As such, Germany abandoned its premium FiT system in favour of a tender/auction system in order to reduce the overall cost of its renewable energy transition. It thereby sought to address the distorting effects of public interventions that "raise[d] the cost of the promotion of renewables and risk hampering both the further growth of renewables and the completion of the internal electricity market" (European Commission, 2013, 3). However, the reform of the EEG is expected to result in a lower growth trajectory of renewables and might endanger the country reaching its 2020 targets (Fichtner, 2016). The importance of Germany's industrial sector also plays a central role regarding the issue surrounding the effects of the pathologically low emission prices of the ETS on the new Energy and Climate Fund. The effectiveness of this system will crucially depend on the political willingness of Germany to accept higher emission prices that could, however, further burden its industries (Chang, 2015). In the UK, adjustments and cuts decreasing financial and regulatory support for renewable energy have been far more significant, possibly due to a generally more sceptical political and economic stance towards renewables and an overall inferior fiscal situation despite (or because of) years of austerity (Carter and Clements, 2015).

Methodologically, the Chapter depicted both the potential and drawbacks of the IPA. The Index provided a comprehensive overview that allowed for the identification of overall policy trends. The analysis of the 'budget' measure further showed the possibilities of the IPA for studies that seek to identify the intensity of particular dimensions of climate policies. Indeed, the assessment of the EEG and RO in terms of their 'imposition' expanded the IPA's application, which normally does not account for this cost dimension of renewable energy policies. However, the IPA scores have also provided some potentially misleading data, for example in the case of the RO's certificate banding that represented a significant improvement over previous policy amendments, yet was not captured by the IPA. Also, the comparability of the scores between Germany and the UK was complicated by the unique situational conditions of each national environment, including the UK's fragmented policy approach that led to lower intensity scores, and the significant differences in the VAT rates (during the 'budget' analysis). While not an issue of the IPA itself that is based on a sound selection of measures and calculation approach, it shows how a comparative index is best combined with an in-depth analysis that can contextualise and provide further explanatory insight to the findings.

3.8 Conclusion

The chapter set out to determine whether austerity and the economic crisis affected renewable energy and climate policy in Germany and the UK, and if yes, how the effects varied in light of the fundamental differences in the political and economic context of the two cases. It did so by first applying the IPA comprehensively to important policies in the two countries, followed by a separate assessment of the 'budget' measure and a brief policy analysis. Methodologically, it thereby showcased both the potentials and limitations of the IPA in addressing intricate energy and climate policy structures.

The analysis showed that austerity was an important factor, yet only one of many influencing renewable energy transitions in Germany and the UK. Austerity's impact was expressed primarily through growing cost concerns. The extent to which these concerns negatively affected renewables depended, however, crucially on the wider economic situation as well as on the fundamental political stance towards renewables. While no clear change in the policy intensity was identified by the IPA, the separate 'budget' analysis and contextualisation identified the important policy adjustments implemented in the two countries that sought to balance the support of renewables with limiting their costs in times of economic and financial hardshi The chapter highlighted the apparent importance of the economy and international targets in form of the 2020 Strategy that encouraged governments not to weaken their climate action more significantly. The economic repercussions of the looming Brexit and a potential exit from the 2020 targets could therefore entail significant changes for the UK's renewable energy and climate policy.

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Chapter 4: Portugal under Austerity: From Financial to Renewable Crisis

4.1 Preface

Austerity's societal and economic implications remain subject of intense debate (Gool and Pearson, 2014; Mckay, 2012; McGrath *et al.*, 2015; Mitchell *et al.*, 2013; Buti and Carnot, 2013; National Children's Bureau, 2012). Despite doubts over austerity's ability to generate greater investor confidence and overcome negative economic growth (Alesina *et al.*, 2014; Busch *et al.*, 2013), fiscal consolidation measures were central to the bailout agreements made between the crisis states and the Troika of European Commission, European Central Bank and International Monetary Fund. This chapter analyses the role of austerity on renewable energy transitions in such a crisis state.

Portugal was identified as a case study tby being in the Eurozone, and having a low GDP per capita and low GDP growth. At the same time, the country boasted a strong progress in its renewable energy transition. Indeed, Portugal has been an important supporter of renewable energy, and made headline news in 2016 when it ran for 107 hours – or four days – solely on renewable electricity (Neslen, 2016). Nevertheless, due to mounting financial pressures in its energy system, the Portuguese government implemented a moratorium on the financial support through its feed-in tariff system for new small-scale hydropower and onshore wind projects in 2012. Since then, no new capacity additions have been contracted. By employing historical institutionalism (HI), this chapter seeks to determine whether the entry of the Troika in 2011 in Portugal represented a critical juncture for the country's renewable energy transition.

Following the analysis of two high income, major European economies, this chapter focuses on a more peripheral member of the European Union and the Eurozone. The case of Portugal shows how growing economic and financial struggles, and a consequent introduction of austerity created a complex policy environment in which fiscal obligations, economic needs, and sustainability ambitions appeared to clash. It thereby represents an extremely important contribution to the aims of the thesis (i-iv), as it shows the direct impact of austerity on renewable energy policy (iii), but it also demonstrates how the consequences of the lack of a more integrated European energy market has affected the financial viability of renewable energy transitions (iv). Indeed, Portugal is shown to be a prime example in which an ineffective European cross-country transmission network directly led to severe financial issues in the country's energy system and thereby prevented a traditionally supportive renewables country continuing its pioneering path.

Despite the influence of austerity on Portugal's renewable energy transition, the application of HI allows us to differentiate between the two institutions of fiscal and environmental sustainability. The results of the analysis thereby shows that policy adjustments made under the auspices of austerity were solely motivated by the growing financial concerns. In addition, the consequent struggles of the Portuguese renewables sector to generate capacity growth were largely due to market issues, rather than a lack of government and public commitment. As such, the financial crisis and austerity can be considered as mere triggers highlighting more fundamental issues in Portugal's fiscal culture, and the structure of the European energy system. The findings of this analysis therefore provide an interesting, new perspective on the implications of austerity for renewables in Europe. While its associated financial concerns have had significant effects on renewable policies, austerity has not undermined the fundamental commitment to sustainability transitions in this crisis state.

This paper is written in the style of the Journal of European Integration to which it was submitted and is currently under review. I declare that the work submitted is my own. The contribution of the co-author is as follows:

Dr. Charlotte Burns: supervision, review and editing.

Dr. Julia Touza: supervision, review and editing.

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Portugal under Austerity: From Financial to Renewable Crisis

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4.3 Abstract

Portugal has been hit hard by the global financial and economic crisis, with concomitant effects upon the development of its renewable energy sector. The imposition of austerity has had negative impacts upon the further development of the Portuguese renewables sector, prompting the question of whether we are seeing a critical juncture that will lead to a new policy trajectory. Historical institutionalist analysis demonstrates a range of unintended consequences arising from the pursuit of austerity in Portugal. The path dependent structure of the Portuguese electricity market and the export bottleneck between the Iberian Peninsula and Central Europe are identified as critical variables explaining the sub-optimal policy trajectory. We conclude that resolving this bottleneck will be critical for Portugal to reduce current financial and electricity price pressures, and continue its renewable energy transition.

Keywords: Austerity; Critical Juncture; Financial Crisis; Historical Institutionalism; Portugal; Renewable Energy

4.4. Introduction

The EU's 2009 Renewable Energy Directive seeks to raise the share of renewable energy in the EU's final energy consumption to 20% by 2020 – a key pillar in Europe's 2020 Strategy (European Commission, 2010). Portugal's own 2020 target was set at 31%, including 60% of its electricity generation to come from renewable energy sources (RES). However, at the same time as Portugal's ambitious targets were approved by the European Commission (EC), the country was under increasing scrutiny by the EU and the International Monetary Fund (IMF) for its high government deficit and increasing debt levels. As the country's financial situation worsened, Portugal requested a bailout from the 'Troika' of the EC, European Central Bank (ECB), and IMF in April 2011. The Troika, in turn, demanded significant structural reforms and the introduction of austerity measures to consolidate Portugal's finances. Part of these consolidation measures was the obligation to eradicate the country's growing Feed-in tariff (FiT) debt, which had emerged due to differences in the actual wholesale price and the set tariff price of electricity. The decision by the authorities not to transfer the growing cost of renewables that grew by 42% between 2009 and 2011, meant the financial burden rested on the last resort supplier of energy, the EDP (European Commission, 2014e). As a consequence, in 2012, the Portuguese government introduced a moratorium on onshore wind-power and small-hydro FiTs with no new licenses being issued. Although the licensing moratorium was lifted in 2013, new projects are not entitled for government support, and to date no respective capacity additions having been contracted.

The financial crisis therefore appears to have had a drastic impact on both Portugal's debt-practices and the country's renewable energy transition (RET), which seems to have become a victim of austerity. Drawing on Historical Institutionalism (HI), we seek to identify whether the country's financial crisis and the entry of the Troika represented a critical juncture for Portugal's renewable electricity sector. We contribute to the vast literature on HI by critically evaluating the applicability of a critical juncture to real-world policy-change in a case in which two separate institutions are interacting, the institutional structures of i) Portugal's fiscal sustainability and ii) sustainable energy. This paper investigates HI in the relatively novel context of renewable energy transitions (Stefes, 2010), for which HI's potential and limitations has been established only recently (Lockwood *et al.*, 2017a). Moreover, thematically, although the Portuguese RET has received significant attention from academics in the past (Pereira and Rodrigues, 2015; Herman, 2013; Delicado *et al.*, 2016; Gouveia *et* *al.*, 2014; Peña *et al.*, 2017; Stefanini, 2016), there are a limited number of analyses on the implications of the economic crisis and austerity on RETs in Europe (Slominski, 2016; Skovgaard, 2014; Andreas *et al.*, 2017), and particularly on crisis countries. We therefore provide a timely analysis of these implications. Our empirical analysis draws on secondary literature, including policy papers, reports, and assessments, and is supported by semi-structured elite interviews.

In section 2, we establish our analytical framework surrounding HI. In our analysis in section 3, we, firstly, establish Portugal's sustainable energy institution, and, secondly, briefly address Portugal's plunge into financial crisis in order to identify the consequences of the entry of the Troika for Portugal's renewables policy. Our results indicate that there has not been a critical juncture for Portugal's renewables sector, but that the current slump in growth is an unintended consequence of the renewable policy adjustments that seek to meet the fiscal requirements imposed by the Troika. In section 4, we discuss the sub-optimal structure of the Portuguese renewables market that played a critical role both in the initial emergence of the tariff debt, and in the current unintended consequences. We conclude that overcoming these structural issues will be crucial for the economic viability of Portugal's RET and can also play an important role in improving the country's wider fiscal situation.

4.5. Analytical Framework

We employ historical institutionalism (HI) as an analytical approach that allows the comparison of institutional structures and the identification of institutional change across time. Our literature review outlines Portugal's renewable energy policy since 1988. In order to establish a comprehensive narrative we also conducted six in-depth semi-structured elite interviews with members of both governmental (European Commission; European Parliament), and non-governmental institutions (WWF Portugal; Portuguese Association for Renewable Energy, APREN; and the European Wind Energy Association, EWEA, now WindEurope). The analytical process was one of triangulation, both guiding and reaffirming the policy analysis.

HI revolves around the notion of institutions, or paradigms (Peters *et al.*, 2005), that are the recurring patterns of behaviour representing the structures and mechanisms of social order within a given context (Capoccia, 2015). It seeks to identify the drivers and limitations of institutional change, how they are formed and evolve. It thereby provides "generalisable explanations of patterns of diversity and change" (Lockwood *et al.*, 2017a, 315). Institutional arrangements within a political context refer to political regimes, single organisations (parties), as well as public policies (Stefes, 2010; Capoccia and Kelemen, 2007). We focus particularly on the latter and consider institutions in the context of our analysis to denote an accepted way of thinking and organising public policy.

Our analysis focuses on two institutions. First, the institution of fiscal sustainability refers both to the existing paradigm that promotes an austere government and liberalised markets, as well as governments that have been running a deficit for decades. This institution follows neo-liberal economic theory in stressing the need of governmental monetary restraint and budgetary austerity to ensure the 'freedom' of markets. Neo-liberalism rose to become the leading economic theory in the 1970s and views excessive debt as undermining economic and financial stability. It therefore holds that debt should be maintained at sustainable (ie. minimal) levels (Checherita and Rother, 2010). Neoliberalism's fundamental ideas are deeply embedded in EU institutions, seen for example in the Eurozone's convergence criteria as part of its Stability and Growth Pact (European Commission, 2015b).

Second, the sustainable energy institution refers to the policies that seek to increase the share of clean, and preferably renewable, energy sources, primarily to reduce the polluting effects of conventional energy sources, such as coal and oil, to combat growing biodiversity losses and mitigate climate change (Cardinale *et al.*, 2012). Beyond its focus on environmental sustainability, the institution has an additional societal dimensions of creating a sustainable economy that is not fuelled by finite energy sources (World Bank, 2012; UNEP, 2009; OECD, 2009), while also improving energy security, and potentially reducing electricity costs in the long run, as most RES have a zero-fuel cost advantage (Klessmann *et al.*, 2008). The sustainable energy institution hence represents the growing global policy trend of breaking the world's dependence on fossil fuels, and requires significant amounts of capital to drive renewable innovation and provide the infrastructural framework for its expansion (Trainer, 2010; Bazilian *et al.*, 2013; Apergis *et al.*, 2010).

The inherent self-reinforcing processes of institutions render them highly rigid in nature (Pierson, 2000a, 492). As such, HI observes that institutions become entrenched on a certain track that is not easily reversed or altered, referred to as 'path dependence' (Stefes, 2010). Particularly in political contexts, institutional structures may suffer from sub-optimal policy developments, in which, due to the stickiness of institutions, actors may protect and reinforce sub-optimal policies. This trend is further aggravated by the fact that actors' behaviour may not be far-sighted and institutional effects may be unintended (Pierson, 2000b). A rather limited time-horizon for action can often be observed in democratic systems, in which the immediate implications of actions taken by a government that seeks to be re-elected commonly outweigh the possibly negative long-term ramifications. An increased acknowledgement of long-term issues can be achieved for example if matters become politically salient or governments are made accountable to actors with longer time horizons, for example by "empowering particular kinds of political actors" (Pierson, 2000b, 480), such as international organisations.

A "rare event in the development of an institution" (Capoccia and Kelemen, 2007, 368) is a so-called critical juncture in which a significant, commonly exogenous, shock facilitates a short period of social and political fluidity, during which the ability of an institution to self-replicate is undermined, allowing for political agency to shape the outcome (Stefes, 2010; Capoccia and Kelemen, 2007; Capoccia, 2015; Collier and Collier, 1993; Pierson, 2000b). The notion of a short period of time stands relative to the duration of the path-dependent phases of the institutional structures preceding and following the critical juncture. Social and political fluidity, or contingency, represents a crucial factor of critical junctures, as it breaks the constraints of the path-dependence phase. Consequently, during the short period of a critical juncture, agents face an increased range of feasible options and choices. The choices made during this time may trigger a new path-dependent process, constraining future choices. As the direction of this process rests with the decisions made by influential agents, their role is critical. As such we focus our policy analysis not solely on the event or accumulation of events that lead to the critical juncture, but on the decisions made by agents that shape the future path-dependent phase.

Critical junctures are commonly associated with, and defined as, "a period of significant change" (Collier and Collier, 1993, 29). However, Capoccia and Kelemen (2007) argue that a critical juncture may also involve the "restoration of the pre-critical juncture status quo" or a "re-equilibrium of an institution" (352). Critical junctures merely create a "substantially heightened probability that agents' choices will affect the outcome" (348), but do not necessarily lead to change in the institutional structures. As traditional critical juncture literature stresses the importance of significant, or paradigmatic, change as part of a critical juncture (Hall & Taylor, 1996, 10; Lockwood *et al.*, 2017a, 323; David, 2007, 3; Peters *et al.*, 2005, 1286), and considering the danger of blurring the qualitative lines towards a mere policy window (Kingdon, 1984), we maintain that significant change represents an essential factor of a critical juncture. In doing so, however, we face the challenge of distinguishing between 'significant' and 'ordinary' change that is common also in path-dependent periods (Peters *et al.*, 2005, 1286).

To identify significant change, the analysis builds on Hall's (1993) fundamental work on the three orders of change in policy paradigms, in which first order changes include adjustments to the kind of existing policies, while second order changes relate to the abolishing of old, and introduction of new policies to achieve certain goals. Both orders of change are considered part of normal policy-making and a policy learning process. Third order changes differ, as they include radical change to the existing policy discourse, leading to discontinuities in policy direction. Only third order policy changes therefore are considered significant for a critical juncture.

Our policy review and in-depth analysis further seek to overcome the qualitative vagueness of critical junctures by focusing on four institutional structures (economic, cultural, ideological, organisational) in order to identify paradigmatic, third order change (Stefes, 2010; Capoccia and

Kelemen, 2007). Capoccia and Kelemen (2007) provide the measuring of a so-called probability jump and a temporal leverage to identify "criticalness" (360). The temporal leverage measures the duration of the outcome of the juncture relative to the duration of the juncture itself. A probability jump refers to the change in probability of the outcome at the end of a critical juncture compared to the lowest point of probability during or prior to the juncture. This approach stresses the importance of decisions that significantly increase the probability of the outcome even before such changes are made during the critical juncture phase. Overall, for a critical juncture to exist based on the above definition, all three aspects need to be met:

(i) Time: short time period relative to the path-dependent periods.

(ii) Contingency: the existence of structural fluctuations that provide a "broader than typical range of feasible options" (Capoccia and Kelemen, 2007, 348).

(iii) Change: third order change affecting the paradigms of institutional structures (economic, cultural, ideological, and organisational).

4.6. Portugal's Renewable Energy Transition And The Financial Crisis

A critical juncture does not necessarily have to be a discrete event but instead can be an "accumulation of related events during a relatively compressed period" (Capoccia and Kelemen, 2007, 350). In the Portuguese case, we consider the period of a potential critical juncture to be between 2010 and 2014, beginning with Portugal's financial crisis in 2010, followed by the developments that led to the country's bailout, the entry of the Troika, and ended with the exit of the three-year EU/IMF financial assistance program in May 2014. Due to the timeliness of the analysis, the notion of temporal leverage, focusing on the duration of the outcome relative to the time of the critical juncture cannot be addressed.

4.6.1. Renewable Energy Trajectory, 1988-2010

Portugal has supported renewable energy since 1988. Wind power only took off in the early 2000s, following the accession of the EU to the Kyoto Protocol in 1998 and the 2001 *Directive 2001/77/EC* that established a 12% renewable energy sources target for gross domestic consumption by 2010 (Peña *et al.*, 2017). New legislation and tariffs in the early 2000s paved the way for a fast expansion of renewables, particularly onshore wind power. Feed-in tariffs (FiTs) represent the back-bone of the Portuguese energy transition and have been updated regularly.

The first support scheme for renewables was established through the *Decree Law 189/88* that installed an undifferentiated FiT system to renewables, which meant that under the technological conditions, the law favoured primarily small-scale hydropower (<10MW). In 1995, Portugal's electricity market was converted from a vertically integrated state monopoly into a dual market structure, comprised of a Public Service System (SEP) and a liberalised system (LM) (Amorim *et al.*, 2013). In the same year, two *Decree Laws 186/95* and *313/95* established a special regime for renewable energy, with developers benefitting from FiTs with purchase obligations by the network operators. The tariff system was adjusted in 1999 under *Decree Law 168/99*, which reorganised the regulatory process, with the calculated tariffs now accounting for the avoided costs of the operation of conventional power plants and the avoided environmental external costs in terms of carbon dioxide (CO_2) emissions.

In 2001, in response to the aforementioned EC Directive on renewable electricity (*2001/77/CE*), the Portuguese government initiated the E4 Programme (Energy Efficiency and Endogenous Energies, *RCM 154/2001*) that established 2010 targets of 39% of electricity from renewables and an overall installed renewable capacity of 8.8GW (including hydropower) leading to further policy improvements through *Decree-Law 312/2001* and *Decree Law 339-C/2001* (Peña *et al.*, 2017). The 2003 Resolution of the Council of Ministries (*RCM 63/2003*) established three bases for Portuguese energy policy: (i) security of supply, (ii) sustainable development, and (iii) promotion of national competitiveness, with the latter driving further market liberalisation. In 2001, the Portuguese and Spanish governments decided to integrate the two countries' electricity market into a single Iberian Electricity Market (MIBEL), rendering the SEP incompatible with the new market. In 2005, Portugal published its first National Energy Strategy foreseeing the extensive restructuring in the organisation and functioning of the electricity, natural gas and petroleum markets in accordance with EU directives (*Directive 2003/54/EC; Directive 2003/55/EC*), and in preparation for the integrated market with Spain. As MIBEL was launched in July 2007, the Portuguese electricity market liberalisation was completed to the degree that all electricity customers were freely able to choose and change their electricity provider (Del Río, 2016). The majority of power purchase agreements (PPAs) were replaced by the capacity system mechanism (CMEC) in 2007, a compensation scheme aimed to equalise revenues under market conditions with the prior agreed PPAs (Autoridade Da Concorrencia, 2007). In 2007, the purchase obligation for energy under the special regime (renewables and cogeneration) was extended to the last-resort supplier, leaving RES generators effectively outside the wholesale market (Amorim *et al.*, 2013).

Portugal ran a three phase multi-criteria auction between 2006 and 2008 for a total of 1.8GW of renewable energy capacity. The auction did not seek primarily to achieve the lowest possible development costs, since this criterion only weighted 20% to the final tender decision. Instead, 45% of the bid decision was made to ensure high direct and indirect investment volumes, as well as a high job creation and gross added value around the development of renewables (Del Río, 2016). In 2007 the target for consumption of energy produced from RES was increased to 45% by 2010.

The government renewable policies of the early 2000s were highly successful in achieving renewable targets. Between 2004 and 2009 more than 500MW of wind power were installed yearly. By 2010, Portugal achieved almost 9.7GW of renewable capacity, including over 3.9GW in wind (IEA Wind, 2013). Electricity from non-hydropower renewables reached a share of 24.4% in total generation, second in the world only to Denmark (IEA, 2016). In the same year, the European Commission approved the National Renewable Energy Action Plan (NREAP) in fulfilment of Portugal's obligations under the EU's 2009 Renewable Energy Directive (*Directive 2009/28/EC*). The Plan included a 2020 capacity target for wind power of 6,875MW of which 75MW were to be offshore. By 2020, Portugal aimed to generate 60% of its electricity from renewables to achieve its final energy consumption target of 31%. At the outset of its financial crisis, Portugal had hence become one of the renewables leaders in Europe, and established one of the most ambitious 2020 targets for renewable electricity (IEA, 2016; Guevara and Domingos, 2017).

4.6.2. The Fiscal Institution and the Financial Crisis

Based on the 1990 Maastricht Treaty, member states of the EMU have to maintain maximum levels of government deficit (3% of GDP) and debt (60% of GDP). Pereira and Wemans (2012) stress that a government deficit has been considered "normal in Portuguese political discourse" (3) as they have been "the rule without exception" (*ibid.*) with only Greece having a similarly poor record (World Bank, 2017a). Portuguese deficit levels have almost consistently exceeded the convergence criterion over the past twenty years (Eurostat, 2017a).

Portugal introduced austerity programmes in 1977, 1983 (Courakis *et al.*, 1993), 1991 (Von Hagen and Strauch, 2001), and again in 2000 when it was subjected to the EU's Excessive Deficit Procedure (Cunha and Braz, 2007; Blanchard, 2007). However, "crucial reforms […] in the public administration, instrumental to curb the growth of compensation of employees, and the private sector social security system were barely initiated" (Cunha and Braz, 2007, 115). Furthermore, in the run up to the 2008 financial crisis, the Portuguese government "did not adapt [its] fiscal policy to the new slow-growth environment" (Eichenbaum *et al.*, 2016, 10). Hence, general government spending increased by 3.3% to an aggregate of 44.4% of GDP between 2000 and 2007, with the debt to GDP ratio increasing from 48% to over 68% (Pereira and Wemans, 2012).

To boost economic growth and prevent a deeper recession, the European Economic Recovery Plan established a fiscal stimulus of 400 billion EUR by March 2009 (Council of the European Union, 2009). In accordance with the intent of this programme and supported by provisions of flexibility in the Stability and Growth Pact, Portugal implemented its own stimulus package that increased the government deficit to 9.8% in 2009 and 11.2% in 2010 (Eurostat, 2017a). As the sovereign debt crisis unfolded through the bailouts of Greece and Ireland in May and

November 2010, Portugal's high public and external debt, paired with slowing growth prospects, led to downward revisions of the country's sovereign credit rating (Almeida *et al.*, 2014). Higher risk premiums charged for borrowing triggered increased costs to service public debt that risked Portugal defaulting, making a bail-out inevitable by April 2011 (Pereira and Wemans, 2012).

4.6.3. The Troika and the Tariff Debt

The memorandum of understanding (MoU) signed in 2011 with the Troika addressed five areas for required reform and adjustments. One of these areas – (iv) markets of goods and services (energy, telecommunications, transport) – required further measures for the liberalisation of the electricity market and, most importantly, an end to the rising tariff debt.

The tariff debt that accumulated from 2007 onwards was associated with a misalignment between regulated tariffs that are based on one-year-ahead estimates on fuel costs and actual market prices, and the so-called policy costs, the production costs originated by government decisions (European Commission, 2016a; Linden *et al.*, 2014). Essentially, "the energy tariff was not enough to cover the costs of buying energy; and politically there's a decision [to be made] to put the burden on consumers or just to accumulate [it as debt]."[22] As the tariff is not paid through the national budget but transferred onto end consumers, in order "to reduce the [tariff] debt, the price of electricity would [have gone up] so much that it [would have been] unsustainable for the economy".[23] As a consequence, the difference between the tariff deficit was borne by the EDP, resulting in a rising tariff debt reached 1.7 billion EUR by 2011 (European Commission, 2016c). As a member of DG ECFIN summarised:

> "the[Portuguese] energy sector is a mirror of what happened in the whole economy; over-indebtedness and not thinking in a sustainable way to repay this debt; and that's when the Troika kicked in saying, this is going too far. The tariff debt we witnessed in Portugal is widely related with political choices that were made but were not budgeted."[24]

[22] EU-P01-ECFIN
[23] EU-P02-ECFIN
[24] EU-P02-ECFIN

The Portuguese government introduced several energy policy packages to fulfil the requirements under the MoU. In 2012, the first package introduced a moratorium on wind-power, co-generation and small-hydro FiTs with no new licenses being issued. Unlike in Spain (Fouquet and Viktoria Nysten, 2015), the moratorium only affected new projects and did not change contracts retroactively after an agreement was reached with wind and small hydro producers who agreed to pay a levy until 2020. The authorities had "formally recognized the right of the affected utilities to recover the corresponding amount" (Linden *et al.*, 2014, 23), and the electricity debt had been securitised by EDP. In 2009, the EDP place about 1.7 million Euro bonds for 2007-09 tariff deficits on the market, with similar subsequent placements. Yet, unlike to the Spanish case, "these bonds do not have an explicit guarantee of the state budget" (European Commission, 2014e). Regulated tariffs for households were gradually abolished between 2013 and 2015 (*ibid.* :30).

Further measures in the subsequent policy packages included, the modification and adjustment of remuneration regimes for cogeneration projects and reduced compensation for the early termination of former long-term power purchase agreements, with additional savings estimated at EUR 1.3bn (European Commission, 2014, 63). A special levy on the energy sector (Exceptional Contribution of the Energy Sector), excluding RES and small operators, was also established. It was initiated primarily due to state budgetary needs and less due to the tariff debt, with only a third of the proceeds allocated to the electricity system to reduce the tariff deficit, and to finance energy efficiency measures. Initially set to run only in 2014, the levy was extended to 2015 and 2016, and added an estimated 50 million EUR to the tariff debt reduction in 2015 (*ibid.*).

Since 2013, onshore wind power, co-generation and small-hydro power projects can again be developed, however without any governmental support, ie. at market prices. However, not a single new project in these technologies has been contracted since then.[25] The savings for the government household of this action were identified at about 2 billion EUR (European Commission, 2016a). In the same year, the government repealed and revised its NREAP through *Cabinet*

[25] EU-P01-ECFIN/PT-P01-APREN

Resolution 20/2013. The new NREAP took into account the falling energy consumption levels as a consequence of the economic crisis (and efficiency improvements), and the adjusted support instruments. It therefore reduced the wind capacity target to a total of 5.3GW (European Union, 2015; European Commission, 2016b). This target was to be reached through already awarded projects primarily from the 2006-2008 auctions, and through repowering and retrofitting existing assets.[26] However, due to policy shifts, even reaching the lowered 2020 NREAP targets has been called into question, and therefore Portugal's overall ability to fulfil its 2020 obligations under the 2009 Renewable Energy Directive.[27]

4.6.4. Juncture or No Juncture?

Taking a step back, the financial and economic crisis in general led to debates over the existing structures of the global financial system with strong advocacy to use the crash to create new economic and financial structures, improving the system's sustainability (Bina and La Camera, 2011; Leichenko *et al.*, 2010; Bina, 2013; Tienhaara, 2010; Reinhart and Rogoff, 2009; UNEP, 2009; Read, 2009; Everett *et al.*, 2010; Edenhofer and Stern, 2009; Foxon, 2013). However, our analysis shows that contingency was expressed differently in the Portuguese case. The requirements imposed by the Troika dictated reforms (liberalisation) and a certain policy path (austerity) to the Portuguese government. The financial shock experienced by Portugal therefore did not lead to an increased range of options for domestic actors, as external actors limited their choices. While the crisis and the subsequent policy requirements of the Troika restricted policy options for domestic authorities, it enforced a fiscal approach that was different to that implemented by domestic actors previously. Through the restriction, the Troika actually provided a new policy option that was unlikely to have been pursued without external pressure (Príncipe, 2013).

However, this increased power of the Troika only addressed issues of fiscal imbalance. The policy decisions made after 2011 sought to halt the further accumulation of tariff debt and, through

[26] PT-P01/2-APREN
[27] PT-01-APREN

the generation of additional revenues, to begin reducing it. The EU had no interest in inhibiting the expansion of renewables, unless it led to higher debt.[28] The policies of the Troika therefore solely targeted the financial unsustainability of Portugal's renewable support system, not its effectiveness in promoting renewables. As Carlos Zorrinho, former Secretary of State for Energy and Innovation (2009-2011) and now member of the European Parliament, stated on the role of the Troika on renewables in Portugal:

> "[The] Troika has a financial approach and not an economic or scientific approach. They don't look how to change the economic model to try to be more competitive. They look to the budget and say how to cut it. The Troika is not for or against renewables; the Troika is for less incentives and more cuts".[29]

Considering Capoccia and Kelemen's (2007) measure of a probability jump, we can see a gradual increase in the probability of a decisive action against the rising financial unsustainability of Portugal's renewable energy policy framework. The creation of MIBEL led to an increasingly liberalised electricity market and aligned prices with Spain. The decision not to counteract the rising tariff debt after 2007 gradually increased the probability of (and need for) decisive action, ultimately enforced through the Troika. Policy-wise, the termination of FiTs for onshore wind power was also justified by concurrent market developments. The increased maturity of renewable technologies led to expectations for wind power to be increasingly competitive at market prices (IEA, 2016), which is represented in the EU guideline to move towards market-based renewable support systems (European Commission, 2013). In addition, the growing market saturation with 5GW of wind capacity installed in 2014 rendered capacity expansions through refitting and upgrading of existing plants a cheaper option for reaching the 2020 targets (Del Río, 2016; IEA, 2016). Further environmental concerns over additional large-scale wind farms played also a role.[30]

Notwithstanding Portugal's decision to terminate FiTs for some renewable technologies, the government continued, for example, its FiT scheme for micro renewable electricity generators

[28] EU-P01-ECFIN
[29] EU-P04-PARL
[30] EU-P01-ECFIN

although at lower rates. In 2011, a new mini generation programme was added to the existing micro one from 2010 (International Energy Agency, 2017). *Decree-Law No.153/2014* further established the legal regimes applicable to the production of electricity for self-consumption from RES thereby supporting the gradual de-centralisation of the grid. Additionally, although the introduced special levy aimed to reduce the budget deficit as part of the economic adjustment programme required by the country's bailout, it explicitly excluded RES and small-scale plants (Energias De Portugal, 2013; EU Business, 2016).

A further important indicator of Portugal's continuation of its renewable path was its '*Green Growth Commitment 2030',* published in 2015, which established new, ambitious renewable targets of 40% in final energy consumption that implied an increase to about 80% in the share of renewables in the country's electricity generation. At its core, the strategy reaffirmed the goal to create green jobs and improve the efficiency of the economy. Culturally and ideologically it thereby represented a continuing positive attitude and commitment to renewables, which have had a significant positive economic effect. The Portuguese wind industry alone supported an estimated 3,200 jobs and generated an income of 1,170 million EUR in 2013, and simultaneously allowed the saving of about 4.3mn tons of CO_2 emissions (IEA Wind, 2013). This CO_2 level reduction also reduced the amount of permits required from the European CO_2 market. According to APREN, the joint benefits of renewables on market prices, reduced fossil fuel imports, saved CO_2 emissions and permit costs are "twice or three times bigger than the [costs of] feed-in tariffs"[31].

The positive impact of renewables for the economy is a fact APREN General Secretary José Manuel Medeiros Pinto says "everyone here in Portuguese society understands".[32] As the rapid rise in renewable energy was driven *inter alia* by economic concerns over rising import costs for fossil fuels and reducing electricity costs, the motives, also including the abovementioned economic advantages, have not reduced during the financial crisis. As such, public support of renewables remains strong: Portugal reached the second highest number of respondents (94%) across the EU

[31] PT-P03-APREN
[32] PT-P03-APREN

finding that nationally set renewable targets for 2030 are important, and the highest number of respondents (84%) agreeing that a reduction of fossil fuel imports will benefit the EU (European Commission, 2015a).

Overall, Portugal's policy adjustments appear financially-induced, while seeking to maintain the advance of the country's renewable energy transition. From a fiscal standpoint even the policy measures introduced were considered largely insufficient by the EC, which stated that:

> "the government did not take sufficient ownership and missed the opportunity to reform more decisively this key sector. […] Eliminating the tariff debt, which is heavily weighing on the high costs of electricity for end users, remains a significant challenge if price increases are to be kept limited as desirable for firms' competitiveness and households' budgets." (European Commission, 2016a, 83)

The EC stressed that the government's resistance to more decisive policy reforms was based on the ongoing privatisation process, and the aim of previous policies to develop green energy (*ibid.*). By 2015 the tariff debt had increased to about 5 billion EUR and in 2016, the Commission raised doubts over its elimination by 2020 under current projections (European Commission, 2016a).

Overall, we can see that there was a complex interplay across fiscal and sustainable energy institutions, and varying agents, such as the Troika and the national government, and requirements of the internationally agreed 2020 targets. Considering the contingency factor, Portugal's financial crisis necessitated a bailout from the Troika, which in turn obligated the Portuguese government to address the fiscal unsustainability of its policies. The financial crisis provided the institutional fluidity that empowered the Troika to impose a policy change by restricting Portugal's choice of options. Although this development hints at a potential critical juncture in Portugal's fiscal sustainability institution, it is too early to tell, as overall public and private debt in Portugal remain high as of end-2016 (International Monetary Fund, 2016; IEA, 2016).

It is, however, difficult to claim that the financial crisis has been a critical juncture for Portugal's renewables sector. Although the fiscal requirements led to several organisational consequences, it did not lead to fundamental cultural or ideological change. Crucially, the aforementioned policy changes are solely of first and second order, and do not indicate a significant, third order, shift in Portugal's sustainable energy institution.

Unwilling to reduce the debt by transferring the extra costs entirely onto end-consumers, the government sought to halt the accumulation of further tariff debt through the cancellation of FiT support for onshore wind and small-scale hydropower. Despite the technologies' maturity and theoretical competitiveness, this decision effectively stopped new projects being contracted. There is, however, no evidence that shows it was the goal of the government to end the capacity expansion of renewables – on the contrary. The moratorium was solely aimed to improve the financial sustainability of the renewable energy transition. The effect of the moratorium in stopping any new projects from being contracted, therefore, should be considered an unintended consequence of policy action taken under the fiscal sustainability institution. In the following section we discuss some structural issues of the Portuguese electricity market that played an influential role in both generating the fiscal unsustainability of Portugal's energy system, and led to the unfavourable market conditions for renewables.

4.7. The Grid Challenge: The Future Of Portugal's Renewables

The central technological challenge of RETs lies with the so-called non-dispatchable, intermittent RES, such as wind power or solar photovoltaics. Wind thereby exerts the largest pressures on the European market due its much greater share, with a total installed capacity of almost 154GW in the EU (Global Wind Energy Council, 2017). In Portugal (total wind capacity of over 5.3GW (*ibid.*)), wind's share of total demand has been recorded to vary between 0% to over 91% (between '07 and '14) (Pereira and Rodrigues, 2015). Since wind power has dispatch priority it causes a "huge variability in the whole supply curve" (Pereira and Rodrigues, 2015, 1; Klessmann *et al.*, 2008). Hence, although wind energy can decrease average wholesale electricity price levels, it also increases the volatility of the price (*ibid*.). This price volatility was exacerbated by falling demand levels during the crisis across

MIBEL that led to periodic oversupplies of electricity.[33] This oversupply could not be balanced through the export of electricity, increasing cost for generators and thereby consumers. Indeed, the trade of electricity through regional cross-border interconnectors is essential for addressing intermittency and to unlock the full potential of Europe's varying geographic endowment for RES (Spiecker *et al.*, 2013; Lynch *et al.*, 2012).

For decades the EU has sought to create a single European electricity market, with a first major step taken in 1996 (*Directive 96/92/EC*). After a slow transposition and implementation of transparency and liberalisation rules, the Juncker Commission prioritised its Energy Union strategy to achieve a fully functioning internal energy market with aligned prices and a significant share of electricity generated through renewables (European Commission, 2017b). However, due to Portugal's geographic position, exporting excess electricity is extremely difficult. While the creation of MIBEL effectively rendered electricity exchange within the Iberian Peninsula a non-issue, Portugal's "main problem is the interconnections with France and with other parts of the continent".[34] "The lack of interconnections between the Iberian Peninsula and France is one of the biggest bottlenecks that you have in the Energy Union and it's a problem for Portugal and Spain to be competitive."[35]

In February 2015 a new interconnector between France and Spain, the first built in almost 30 years, was inaugurated with the plan to double the, until then, existing commercial exchange capacity to 2.8GW (Carvalho Figueiredo and Pereira da Silva, 2015). Yet, this capacity remains comparatively low, as France resists greater interconnection in fear of cheap Iberian renewable electricity flooding its subsidised, nuclear power dominated electricity market (Euractiv, 2014).[36] Germany, in comparison, had an available interconnection capacity of 21.3GW in 2012 (Bayer, 2015). As such "MIBEL can be seen as an almost isolated system, as the interconnection capacity between

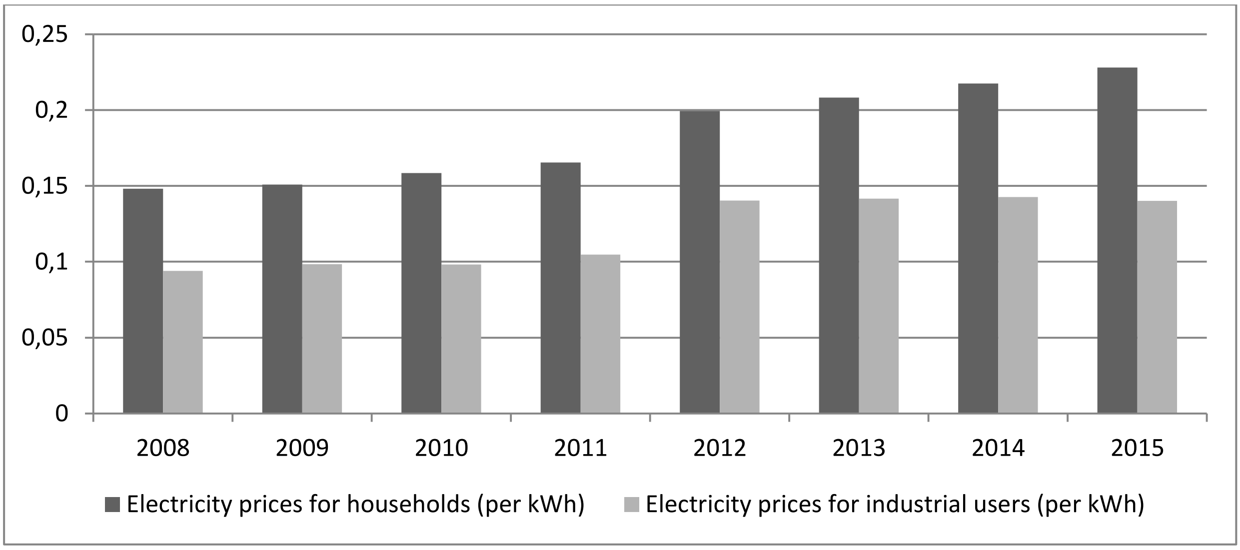
[33] PT-P03-APREN
[34] EU-P04-PARL
[35] EU-P04-PARL
[36] EU-PO3-ENER

Spain and France represents a very small fraction of the total MIBEL capacity" (Pereira *et al.*, 2016, p2–3).

The EU and the International Energy Agency (2015a) consider competition the most effective way to achieve low energy cost and prices (Ferreira *et al.*, 2007). The shortage in regional interconnectors from the Iberian Peninsula to Central Europe and therefore the inability to sell sufficient amounts of generated electricity represents a significant burden for the Iberian electricity market. Jointly, in 2013, Spain and Portugal consumed just 82.7% of total electricity produced (OECD and IEA, 2015). In the most recently available data[37], for 2015, Portugal had a gross electricity production of 52.4GWh and consumed 46.8GWh, reaffirming the general trend of production exceeding consumption (PORDATA, 2017).

While gradually aligned across the Iberian Peninsula, Portugal's electricity prices remain among the highest in the EU and have been increasing significantly over the past years, also due to rising taxation levels and introduced levies following the Troika's entry in 2011; such as the VAT increase from 6% to 23% (compare Figure 1) (IEA, 2016).

Figure 5: Portuguese Electricity prices for households and industrial users (per kWh), 2008-2015



Source: (PORDATA 2016)

[37] At the time of writing.

Although we are not aware of any study assessing the effect of interconnectors (or the lack thereof) between Spain and France on MIBEL's electricity prices, other work on the impact of cross-border electricity transmission on market prices and volatility in relation to renewables showed a transfer of volatility across borders (Phan and Roques, 2015), while several reports established general price and welfare benefits for energy generators and consumers (Unger and Murray, 2014; Schaber *et al.*, 2012; Denny *et al.*, 2010). Generally, shocks affecting the output of electricity can be absorbed more easily and faster in larger electric systems, as has also been observed in the case of MIBEL (Pereira *et al.*, 2016). Although not primarily an issue of austerity or the economic crisis, the political decision to prevent a greater interconnection between Spain and France prohibits potentially significant economic benefits for Portugal, as seen in other case studies (Lockwood *et al.*, 2017a).

In summary, the stagnating and falling electricity consumption levels during the financial crisis did not provide market incentives for additional capacity. Additionally, times of oversupply and lack of export possibilities due to the isolation of the Iberian electricity market acted to amplify unfavourable market conditions. Without an adequate connection to the European market, both Portugal and Spain will therefore continue to struggle to promote a cost-effective RET. Generous FiT schemes of the past have left a financial burden on both consumers and state budgets. However, the EU's favoured path towards renewable auction systems is unlikely to provide the necessary financial incentives under current market conditions and uncertainties over domestic demand and the export bottleneck. As a member of DG Energy stated: "without a good development of interconnections you cannot really benefit from the full potential of renewable energy in Portugal and in Spain. If you want to get closer to market values, you need to be able to export".[38]

4.8. Conclusions

At first sight, the effects of austerity during Portugal's financial crisis from 2010 to 2014 on the country's renewable energy transition appeared to be a significant break with its previously

[38] EU-P03-ENER

supportive stance. However, through the application of HI, the analysis was able to determine that there has not been a critical juncture for Portugal's renewables sector. At the same time, the approach stressed the significant of sub-optimal structures as the result of policy decisions in the past that can have severe implications for current policy challenges. The paper thereby highlighted the quality of HI in providing an analytical framework for differentiation in situations of complex agency and intertwined institutions. By distinguishing between the two institutions of fiscal and environmental sustainability, we showed that the policy adjustments induced by the requirements of the Troika were of first and second order, solely targeted at the financial unsustainability of Portugal's renewables sector. They did not encompass third order, paradigmatic change and therefore a juncture in the country's environmental sustainability path – despite the negative implications for new onshore wind and small-scale hydropower projects.

In terms of the three conditions of a critical juncture, the case of Portugal i) presents a limited timeframe from 2010-2014, and ii) shows a degree of contingency through the financial crisis that allowed the Troika to influence the country's fiscal policy. However, this influence in fact translated into a more limited, rather than expanded choice in policy instruments for the national government. As such, iii) the analysis could not identify a significant shift in the environmental sustainability institution in Portugal. The renewable policy adjustments in Portugal sought to comply with the requirements imposed by the Troika, but did not result in a paradigmatic change in the environmental sustainability institution itself. The analysis provided several examples of an ongoing public and political support of green growth, renewables, and climate action.

The analysis depicted the intertwined 'cause and effect' relationship between two distinct institutions. It showed that the policy changes affecting Portugal's renewables sector, and thereby its environmental sustainability institution, were solely induced by, and therefore the result of, the requirements of the fiscal sustainability institution. The current obstacles in Portugal's renewable energy transitions must therefore be considered 'unintended consequences' of actions taken under the country's shifting fiscal policy in the wake of austerity with the aim to address the financial imbalances of Portugal's energy system. The paper subsequently highlighted the structural issues – notably the export bottleneck with France – that played an influential role both in the creation of the financially unsustainable energy system in Portugal, and the severity of the impact of the policy changes in the wake of austerity.

The current challenges of Portugal's renewable energy transition therefore do not represent a critical juncture as a result of the financial crisis. Instead, the financial crisis and austerity merely highlighted the fundamental structural issues of the Portuguese and European electricity market. In fact, it was the government's willingness to accept a rising tariff debt in order to drive renewables despite the sub-optimal structure of the Portuguese energy market that led to the financial struggles of its energy system, which ultimately had to be addressed under the Troika. In conclusion, to overcome both Portugal's financial issues, and to improve the economic viability of its renewable sector requires improved interconnection between the Iberian Peninsula and the rest of Europe, which would further allow an improved balancing of intermittent renewable energy sources across the European electricity markets.

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Chapter 5: Overcoming Energy Injustice? Bulgaria's Renewable Energy Transition in Times of Crisis

5.1 Preface

Underlying the central research question of this project stands the challenge of facilitating costly renewable energy transitions in a time of economic and financial hardship. So far, the thesis has analysed this difficult challenge in two high income countries of the EU, Germany and the UK that nevertheless struggled with rising energy costs, and under the auspices of austerity adjusted their renewable energy policies accordingly. It also analysed the direct influence of the Troika in a crisis state that has been one of the green pioneers in Europe, Portugal, and showed both the severe implications of austerity on renewable energy policy, as well as the structural issues of the European energy market impeding the economic viability of renewables.

As the last of the four case studies of the small-n analysis, this chapter addresses the renewables expansion in Bulgaria, the EU's poorest member-state, yet also its first to achieve its 2020 targets as of 2013. As Bulgaria has been largely shielded from the effects of the economic and financial crisis, the analysis determines how the country was able to reach its targets in times of economic crisis and austerity, yet also at what cost for its economy and society. It identifies and tests some general assumption of factors shaping renewable energy transitions that have been applied primarily in the context of high income states. It further analyses the role of renewables in improving the equity, justice, and fairness of a country's energy system through the lens of energy justice.

As part of the thesis, the chapter complements the previous analyses by providing the perspective of a low-income country's apparent success in driving renewable energy transitions despite the economic crisis and austerity. It thereby, however, shows the implications of such a rapid transition in a weak economic environment, and highlights the dangers of renewable energy transitions in unjustly overburdening society. Crucially, the analysis stresses the potential of external targets to be abused in the absence of a domestic public and governmental commitment towards sustainability, and particularly in a political environment that suffers from corruption and cronyism. The chapter thereby provides an important perspective to the debate of the potential costs of renewables, measured not only in terms of rising electricity prices. The findings of the analysis emphasize the need for a long-term strategy and public support of renewable energy transitions under a dynamic and responsive policy framework.

Despite the apparent success of Bulgaria's renewable expansion during the economic crisis and austerity, the cost of renewables also plays a central role in this chapter. Employing a standard feed-in tariff system, the costs for renewables were borne by the state-owned electric company initially obligated to buy renewables as part of their priority access. Since Bulgaria's consumer electricity prices are regulated, authorities decided not to reflect the sharp increase in generation costs, due to increasing renewables on the grid, in the price of electricity. Like Portugal, Bulgaria therefore also ran a significant tariff debt. However, the Bulgarian authorities did not recognise this debt as public liability, which prevented it from affecting the country's debt statistics. Nevertheless, the financial unsustainability of forcing the state-owned electric company to bear the difference between the growing generation costs of the electricity system and the largely unchanged, regulated electricity price of consumers caught up with the government eventually, resulting in political crisis and the effective termination of Bulgaria's renewable energy transition.

This paper is written in the style of the Journal of Energy Research & Social Sciences to which it was submitted and accepted for publication. I declare that the work submitted is my own. The contribution of the co-author is as follows:

Dr. Charlotte Burns: supervision, review and editing.

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Overcoming Energy Injustice? Bulgaria's Renewable Energy Transition in Times of Crisis

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5.2 Abstract

The potential effects of renewable energy transitions on energy costs and economic growth have led to cost concerns and a prioritisation of economic issues during the economic crisis. However, Bulgaria, the EU's poorest state had by 2013 already achieved its renewable energy targets under the Europe 2020 Strategy. This achievement seems to challenge the widely held assumption that poorer countries struggle to meet environmental objectives. This paper analyses the drivers and implications of Bulgaria's rapid renewables expansion in order to test general assumptions on influential factors shaping renewable energy transitions in the context of poor states. The analysis employs the energy justice framework to identify the implications of Bulgaria's renewable energy transition for the justice, equity and fairness of its energy system. Despite the clear justice implications raised by changing the structure of energy systems, there are limited pieces analysing the relationship between renewable energy transitions and wider energy justice issues. The analysis shows that whilst Bulgaria was able to rapidly reach its renewables targets, the mismanaged, opaque and corrupted renewables policy framework undermines the long-term viability of its transition to renewable energy. The analysis confirms the importance of long term strategies, effective policies and a supportive macroeconomic context for renewable energy transitions, and highlights the potentially negative implications of renewables to achieve greater energy justice if these factors are omitted.

Keywords: Bulgaria; Corruption; Energy Justice; Europe 2020 Strategy; Renewable Energy

5.3 Introduction

Renewable energy transitions are considered expensive due to their high initial capital costs and hence require regulatory support, for example through preferential pricing mechanisms (Owen, 2006; Nelson *et al.*, 2014). However, subsequently increasing electricity prices, paired with a displacement of fossil fuel industries, have potentially negative effects on the economy by increasing energy prices thereby decelerating economic activity and threating economic competitiveness (Frondel *et al.*, 2010; Berk and Yetkiner, 2014; Marques and Fuinhas, 2012). As such, in the wake of the European economic and debt crisis, Slominski (2016) suggests that economic issues have been prioritised over climate change, as concerns over the cost implications of climate measures heightened. Nevertheless, in 2013 Bulgaria became the first EU member-state to reach and exceed its renewable targets under the Europe 2020 Strategy after having essentially no renewable energy installed prior to its accession in 2007 (with the exception of large-scale hydropower). This article therefore seeks to determine how Bulgaria, as the poorest EU member-state, managed to meet its 2020 renewable targets in times of economic crisis and austerity, and the consequences for its economy and energy system.

Generally, contemporary literature has identified several influential factors shaping renewable energy transitions, such as the need for a strong long-term political support (Fabra *et al.*, 2015), an effective and dynamic policy design (Nicholls *et al.*, 2014; Haas, Panzer, *et al.*, 2011; Haas, Resch, *et al.*, 2011), as well as a supportive macroeconomic context, such as high levels of income (Eyraud *et al.*, 2011). At the same time, expanding renewables is associated with wider environmental, economic and societal benefits. These include lower energy costs in the medium to long-run (Fabra *et al.*, 2015), as well as an improved availability and sustainability of the energy system in terms of reduced emissions, distributed power generators, and an infinite resource availability (International Energy Agency, 2009; World Nuclear Association, 2011; Omer, 2008; Chodkowska-Miszczuk, 2014). However, the majority of literature on renewable energy transitions has focussed on high income countries, such as Denmark, Germany, and the UK (Foxon *et al.*, 2008;

Cherrington *et al.*, 2013; Toke, 2011; Lund, 2007; Jacobsson and Lauber, 2006; Lehr *et al.*, 2012; Stefes, 2010). It is therefore important to address how well these assumptions and potential benefits stand up in a low income country.

Furthermore, the benefits of renewable energy transitions resonate with several aspects of energy justice that aim to ensure access to clean and affordable energy, and to overcome the unequal distribution of environmental ills associated with the production and use of energy through an inclusive and transparent process in the development and implementation of energy projects and policies (Jenkins *et al.*, 2017). Energy justice thereby provides a comprehensive analytical framework for researching energy systems, and can be applied as a "conceptual tool for ethicists, an analytical tool for energy researchers, and a decision-making tool for policy-makers" (Sovacool and Dworkin, 2015; Islar *et al.*, 2017, 671). Although renewables are part of energy justice debates, current literature has so far not comprehensively addressed the opportunities and risks in promoting energy justice through an expansion of renewables (Fuller and McCauley, 2016; Jenkins *et al.*, 2017, 2016; Sovacool and Dworkin, 2015). This paper therefore hopes to help close this gap by addressing the societal and economic impacts of Bulgaria's renewable energy transition in terms of energy justice, and thereby provide a potential pathway for future analyses. By acknowledging the underlying normative views of energy justice, we find that the justice implications of energy policy have to be taken into account and therefore employ energy justice primarily as an analytical tool to identify these implications in the Bulgarian case. The analysis further contributes to our contemporary understanding of the drivers and factors shaping renewable energy transitions in a lower income country by analysing the largely under-researched case of Bulgaria.

The paper begins with an outline of our methodological approach. The analysis itself is split into three sections. The first addresses how Bulgaria achieved its 2020 targets. In this section, we conduct a brief policy analysis of the regulatory framework that drove the transition, and draw from a set of semi-structured interviews to identify the key influential factors that established the favourable policy environment. In the second section, we analyse the consequences of Bulgaria's fast expansion of renewables. In the last section of the analysis, we assess the case of Bulgaria's renewable energy transition through the lens of energy justice. We then discuss our findings and offer some conclusions.

5.4 Methodological Approach

Our analysis employs a mixed-method approach, including a set of semi-structured expert interviews, as well as analyses of major policies and reports, and is supported by secondary sources, such as peer-reviewed articles. Between February and April 2017, we conducted eight interviews with members of non-governmental organisations, academia, and the media, as well as politicians and civil servants to establish the factors influencing Bulgaria's renewable energy transition and to gain insights into its consequences. Interview contributions are numbered and abbreviated according to their affiliation.[39] The paper is guided by these semi-structured interviews and supported by the qualitative analysis.

Adding to the findings of the initial investigation we assess Bulgaria's renewables expansion in light of energy justice. Rooted in environmental justice, this approach questions the justice, equity and fairness of contemporary energy systems and follows the three tenets of distributional justice (benefits and burdens of energy systems), procedural justice (fair, transparent, non-discriminatory and inclusive decision-making processes), and justice as recognition (uphold human dignity) (McCauley *et al.*, 2013; Islar *et al.*, 2017). Energy justice thereby incorporates issues of economics, scarcity and pollution by focusing on decision-making processes of energy, and its production, generation, and consumption, as well as consequent societal implications though a lens of intra- and intergenerational justice (Sovacool and Dworkin, 2015; Islar *et al.*, 2017).

Based on the three justice tenets, Sovacool and Dworkin (2015) establish eight principles of energy justice: availability (access to energy), affordability (cost of energy), due process (stakeholder

[39] Academia (ACAD), Bulgarian Energy and Mining Forum (BEMF), Center for the Study of Democracy (CSD), Government (GOV), Green Party (GREEN), Media Outlet (NEW), and the WWF (WWF).

participation, rule of law), good governance (fair and transparent decision-making processes; effective, efficient and responsive legislation), sustainability (sustainable use of resources), intragenerational equity (equal access to basic energy services), intergenerational equity (right of future generations to live undisturbed of the damage inflicted by today's energy systems), and responsibility (all nations are responsible to minimise energy-related environmental threats). While these principles allow for a more specialised analysis of energy justice factors, they are highly interrelated and mutually reinforcing. We therefore analyse them in a grouped format. Furthermore, justice is an inherently contested concept and therefore, rather than considering justice as an absolute, we seek to identify trends towards an improved justice in Bulgaria's energy system. In the following we outline the groups of analysis and how we measure achieving, or failing to achieve, greater energy justice in each principle.

We firstly analyse the principles of 'due process' and 'good governance', addressing primarily the procedural justice and justice as recognition tenets. We identify 'due process' through (i) the inclusion of relevant stakeholders in the decision-making processes and effective consultations with affected communities, and (ii) the provision of environmental and social impact assessments. 'Good governance' is identified according to a low level of corruption, transparent government actions, and the provision of effective, efficient and responsive legislation. We therefore assess (i) if the Bulgarian government made information on policies and agreements publicly available, and (ii) if implemented policies achieved their intentions at a minimal cost for affected parties, for example by also being adjustable to unforeseen contextual changes.

Secondly, we focus on the distributive justice tenet by determining the availability, affordability and sustainability principles. As 'availability' is improved if a country can guarantee the undisrupted provision of high-quality energy services to its population, we determine improvements in terms of overall energy dependence levels, stability of the grid (represented through distribution losses), and quality of energy supply. 'Affordability' is concerned with energy costs borne by consumers and improved – and thereby measured – according to price stability (minimal volatility) and actual costs that are not to exceed 10% of income, which is the threshold of energy poverty (Islar *et al.*, 2017). We measure improved 'sustainability' from a climate and energy perspective. We therefore assess whether emission levels have been reduced and renewable energy sources increased. Renewables are the most sustainable energy sources since they do not require the exploitation of finite resource stocks.

Finally, we address intra and inter-generational equity and responsibility. As each principle is dependent on the achievements in already analysed justice principles, this group acts somewhat as an overall summary of energy justice in terms of contemporary justice, future justice, and the role of government. 'Intragenerational equity' represents a combination of above factors of access to energy to all (availability) without discrimination (due process/good governance), at a price that neither overburdens poorer sections of society (affordability), nor results in the pollution of environmental goods, such as air (sustainability). 'Intergenerational equity', in turn, is concerned with the effects of contemporary actions for future generations, and thereby depends on the current meeting of energy justice principles that affect the future, particularly the sustainability principle. Also relating particularly to current sustainability actions is the principle of 'responsibility' that considers nations to be responsible to protect the natural environment, limit social and environmental costs associated with the production and use of energy. It therefore considers the ability and willingness of the government to improve the sustainability of its energy system.

5.5 Enabling Bulgaria's Renewable Energy Transitions in Times of Crisis

The global financial and economic crisis paired with the European Debt Crisis had extensive implications for the Bulgarian economy that suffered from an unfavourable international market, and a decreasing purchasing power of the population in light of rising unemployment levels, which led to falling government revenues (Petkov, 2014; Milio *et al.*, 2014). With a traditional focus on maintaining a balanced budget, Bulgaria quickly introduced austerity measures to counteract a growing government deficit primarily by slashing expenditures, for example, in public services and environmental protection (Petkov, 2014). By 2012, deficit levels had returned to a healthy 0.8% with austerity generally considered a success (Eurostat, 2017a).

For the renewable energy market, the economic crisis initially had a positive effect. Based on Bulgaria's first renewables law of 2007, the country had established generous feed-in tariffs (FITs) for renewables at almost 140EUR/MWh for wind under 15 year contracts, and between 718 and 782EUR/MWh for solar photovoltaics (PV) under 25 year contracts, depending on size (EREC, 2009). Initial renewable projects were developed mostly by regional developers with links to criminal organisations and politicians.[40] Yet, as the economic crisis led to reduced investment opportunities and renewable support in some European markets, Bulgaria's highly attractive renewable support also drew a large number of international developers, resulting in a fast growing interest in renewable investments in Bulgaria (Winkel *et al.*, 2011).[41] In 2008, the National Electric Company (NEC) received requests for almost 7.7GW of wind power alone (Center for the Study of Democracy, 2010). The 2009 Renewable Energy Directive – the basis for the 2010 Europe 2020 Strategy and its renewable targets (European Commission, 2010) – induced further beneficial policy adjustments that, for example, guaranteed connection to the grid and priority dispatch for renewables, and provided for shared costs in the construction and connection of renewables, with the largest share being taken over by the distribution company (Republic of Bulgaria, 2011). The FiT price was recalculated to amount to 80% of the average selling price of electricity in the reference year, plus a surcharge equivalent to, or higher than, the surcharge of the previous year (Gramatikova, 2012; RES Legal, 2017; Republic of Bulgaria, 2011).

By 2011, about 10GW worth of renewable projects applied for connection; exceeding the capacity of the energy system by approximately 100% (Gramatikova, 2012). Additionally, falling price levels for PV solar and the inability of preferential price levels to be adequately adjusted led to a surge in projects in 2012 that saw solar capacity increase almost seven-fold compared to 2011. While the National Renewable Energy Action Plan envisaged solar PV capacity to reach 300-320MW

[40] BG-WWF-001
[41] BG-WWF-001; BG-NEW-01

by 2020 (Republic of Bulgaria, 2011, 159), actual solar capacity grew from 150MW in 2011 to over 1GW in 2012 (Nikolaev and Konidari, 2017). Unforeseen by the government, these growth levels meant that by late 2012, Bulgaria had already met and exceeded its 2020 target for final energy of 16%, reaching over 17% in 2013 (EurObserv'Er, 2015).

While the economic crisis effectively re-directed freed capital from other renewable energy markets to Bulgaria, it was the particular characteristics of the regulatory environment in Bulgaria that enabled the rapid expansion of renewables. In this sense, corruption and bad governance have been associated with the promotion of renewable energy in Bulgaria from its inception. Generally, the Global Competitiveness Index identified inefficient government bureaucracy and corruption as the country's most problematic factors for years (World Economic Forum, 2007, 2016). As such, state capture, cronyism, dysfunctional state institutions and corrupt judiciaries remain a fundamental concern in Bulgaria (OECD, 2013). Indeed, at the time of accession, rather than fulfilling the requirements of the *acquis communautaire*, corruption was seen to increase (Vachudova and Spendzharova, 2012), resulting in the initiation of the Cooperation and Verification Mechanism (CVM) by the European Commission (European Commission, 2017b).[42] In 2008 the EU froze a significant amount of funds[43] for Bulgaria after corruption in the disbursement of regional development moneys by Bulgaria's state administration came to light (Vachudova, 2009). As such, the renewable policy in 2008 is said to have had little to do with sustainable energy policy or climate change, but with ways to find additional finance opportunities from the EU, for example through the EBRD's sustainable energy financing facilities (EBRD, n/a).[44] Indeed, as a new member to the EU, Bulgaria saw significant funding opportunities through the promotion of renewable energy (Hiteva and Maltby, 2017).

[42] The CVM seeks "to address shortcomings in the judicial reform, and the fight against corruption and organised crime" (European Commission, 2017c, 2).

[43] The EC "cut off Bulgaria's funding for road construction after the arrest for bribery of two Bulgarian road agency officials. Some €115 million in money destined for roads were frozen, followed by €121 million in money earmarked for agricultural and rural development." (Vachudova, 2009, 54)

[44] BG-CSD-01

Being pushed for by developers and investors, the resulting lucrative opportunities were presented by the government as the result of merely following their obligations under the EU framework.[45] In fact, the promotion of renewable energy in Bulgaria followed a top-down Europeanisation process also prior to the 2020 Strategy (Hiteva and Maltby, 2017). However, the public saw renewable policy to be primarily driven "by private interest and made in such a way as to generate maximum profit".[46] For example, while the 2011 Energy from Renewable Sources Act (ERSA) lowered Feed-in Tariff (FiT) rates and the length of purchase contracts for renewable projects, any project connected to the market prior to 2008 was explicitly exempt from these changes (Government of Bulgaria, 2011a). These few projects were implemented by "offshore companies that are in one way or another related to the Bulgarian Mafia [and that] are still getting the higher price of tariffs [read, the unreduced price]. Most of them are associated with politicians from the Socialist Party, the former Communist Party".[47]

The initially generous renewable incentives are therefore commonly associated with a mutually beneficial relationship between developers, investors and politicians with several MPs also being accused of making legislation in favour of their own business interests, having invested themselves in renewable projects.[48] As such, the strong influence of certain interest groups directly led to the rapid expansion in renewable capacity, as "renewable energy producers and their investors were pressing for good conditions".[49]

5.6 The Implications of Bulgaria's Renewable Expansion

Fuelled by the generous FiT scheme, renewable capacity grew at a rate that challenged both the grid operator and electric companies. The transmission system operator (TSO) struggled severely in the early years of the rapid capacity growth to accommodate the connection of all new renewable

[45] BG-NEW-01; BG-GOV-01
[46] BG-CSD-01
[47] BG-WWF-01
[48] BG-GREEN-01
[49] BG-ACAD-01

projects. As the TSO was legally obligated to provide grid connection and priority access to renewables, Bulgaria was criticised by the EU over its failure to provide appropriate mechanisms regulating the connection of renewables to the grid (Kirov, 2012). Indeed, the regulatory framework did not provide incentives for the development of the grid, which resulted in a shortage of transmission capacity. Furthermore, about 50% of wind power is located in the north-east region of the country, far from major population/consumption centres of Sofia and Plovdiv in the west and south-west (Jirous *et al.*, 2011). In order not to be subjected to fines by infringing on its connection obligation, officially, the TSO argued that the effective curtailing of wind energy plants in this region to 50% of capacity was to the benefit of the grid system as only few renewable sources could serve as balancing capacities (Jirous *et al.*, 2011).

In light of the vast amount of renewables projects that sought development, distribution companies began rejecting connection applications in 2010, and awaited the announced policy amendments by the Bulgarian government for 2011 (Winkel *et al.*, 2011; Gramatikova, 2012). Bulgaria's *Energy From Renewable Energy Sources Act* (ERSA) from May 2011 abolished priority access for renewables to ease the pressure on the grid and introduced obligatory advance payments of renewable developers to counteract speculative projects (Government of Bulgaria, 2011a). The Act further adjusted the renewable growth trajectory to 1% per year, which in effect would render Bulgaria unable to reach the 2020 targets of 16%, and reduced the duration of purchase contracts retroactively, while restricting medium and large scale investment projects (Government of Bulgaria, 2011a). The Act reorganised the administrative unit promoting renewable energy production by converting the Energy Efficiency Agency into the Agency for Sustainable Energy Development. Although the rules of regulation for the agency were finally agreed upon by October 2011, the Agency only effectively began work in 2012 (Winkel *et al.*, 2011).

Additional policy changes affected the price determination of FITs for wind projects as well as amendments to the Energy Act concerning the liberalisation of the energy sector. However, tariffs continued to be calculated and set for the whole period starting on the first of April each year to the thirty-first of March the next year in advance with little to no flexibility to respond to developments on the energy market and falling technology costs[50] (Gramatikova, 2012; Bulgaria State Gazette, 2013). As such, in 2011 FiT rates for solar PV projects were set just weeks before a significant drop in technology costs, with no changes to the rates possible afterwards.[51] The consequent boom in solar capacity development, and hence the reaching of its 2020 targets by the end of 2012, resulted in a moratorium on FiTs for new projects in 2013. In February 2015, the feed-in tariff scheme was officially ended for new renewable energy installations (EurObserv'Er, 2015). Hence, renewable capacity growth has decreased substantially, coming to an almost complete halt in 2015 (EurObserv'Er, 2015).[52]

Critically, the 'success' of the renewable energy transition thus far had come at an immense cost, considering electricity prices for lignite stood at about EUR13.5 per MWh in 2013, and preferential prices for solar and wind stood at EUR 118.3/MWh and EUR 66.35/MWh respectively (Center for the Study of Democracy, 2014, 69). A threefold increase in CHP cogeneration electricity at prices between EUR 65/MWH and EUR 70/MWh further led to rising costs of the energy system (Center for the Study of Democracy, 2014). While Bulgaria has the lowest electricity and gas prices in the EU, in terms of purchasing power standard Bulgaria's prices are substantially higher than the EU average (European Commission, 2013). With energy poverty considered a major threat in Bulgaria's 2011 energy strategy (Government of Bulgaria, 2011b), the government decided not to transfer the entire cost of renewables onto end-consumers. Nevertheless, rising electricity bills played a triggering role in the protests emerging in the winter of 2013 that forced Prime Minister Borisov to resign in February 2013 (Ivancheva, 2013; Velinova *et al.*, 2015; Smilov, 2015). This development ultimately plunged the country into political crisis as repeated protest waves led to three interim

[50] BG-ACAD-01
[51] BG-NEW-01
[52] While year-on-year renewable capacity growth, including hydropower, stood at 6.8% in 2011 and 28% in 2012, in 2013 this had fallen to just above 1%, to 0.91% in 2014, and less than 0.35% in 2015 (Nikolaev and Konidari, 2017).

governments and three elected governments between 2012 and 2017 with Borisov returning to office in 2014 and again in 2017 (Deloy, 2017, 2014).

The economic crisis played a further negative role with regard to the financing of Bulgaria's energy system, as the country used to balance the low regulated electricity prices domestically through the revenues generated through the export of electricity. However, with a weakened demand from markets, such as Greece, Macedonia and Turkey during the crisis, and a strong increase in renewables in neighbouring countries such as Romania, export revenues were falling with the cost for energy increased (Hiteva and Maltby, 2017).[53] Although the generous FiT scheme and rising renewables shares played an important role in the overall increased costs of Bulgaria's energy system, additional financial burdens stemmed from long-term power purchase agreements with coal and nuclear plant operators, and "black hole investment projects", such as the recently failed Belene nuclear power plant project (Center for the Study of Democracy, 2014, 71). As generation costs increased higher than utilities could lawfully charge their customers under the regulated pricing regime, the Bulgarian state-owned electric company (NEC) ran a severe deficit that resulted in a debt of BGN 1.9 billion, or 2% of GDP, in 2015 (World Bank, 2016). This debt is however not recognised by the authorities as a public liability (European Commission, 2014e). Nevertheless, to combat the significant tariff debt, the World Bank (2016) urged Bulgaria to abandon its single-buyer model in favour of a competitive power market that would also be in accordance with the EU's internal electricity market. The single-buyer, the NEC, is severely burdened by bearing the cost of the energy system and was at times unable to remunerate energy generators due to cash flow problems.[54] However, following the recommendation to continue the process of full market liberalisation and coupling with the EU electricity market is feared to result in sharply rising electricity prices, as Bulgaria's low consumer electricity prices align with other European markets (Eurostat, 2017a; Center for the Study of Democracy, 2014).

[53] BG-CSD-01

[54] In 2014, the NEC owed some USD500 million to generating companies (Ewing and Kantchev, 2014)

As a result of the dire financial situation, government policies sought to decrease costs and increase revenues from the energy system, for example through the 2012 grid access fees to renewable energy generators, which was, however, later repealed by the Constitutional Court on discriminatory grounds (Grozdanov, 2016). In December 2013, an amendment to the ERSA introduced a 20% fee on solar and wind parks, adjusted FIT rates retroactively, and established a threshold for the amount of electricity purchased at an FIT rate by the State Regulatory Energy and Water Commission equivalent to about two-thirds of the generation capacity[55] (International Energy Agency, 2015b). This cap on renewables effectively excluded renewables from the free market for the last two months in 2015 (Grozdanov, 2016). The 20% renewables fee was again repealed by the constitutional court and since 2015 replaced by a 5% production fee and balancing charges on the revenues of all electricity generators (International Energy Agency, 2015a).

5.7 Bulgaria's Renewable Energy Transition in Light of Energy Justice

In light of the outlined successes, challenges and implications of Bulgaria's renewable energy expansion, this section assesses the country's renewable energy transition through the lens of energy justice. This section analyses the eight aspects of energy justice in a grouped format. As the expansion of renewables plays an important role with regard to the aims of energy justice, we seek to determine the concrete effects of Bulgaria's renewable energy transition on the justice, equity and fairness of the country's energy system. Other important factors include the effectiveness and efficiency of the regulatory framework, as well as oversight and participatory concerns.

5.7.1 Due Process and Good Governance

Bulgaria's renewable policy has been marred by a lack of a long-term strategy, corruption and administrative incompetence that resulted in frequent policy changes and therefore a significant lack of regulatory stability (Hiteva and Maltby, 2017). In this sub-section we address (i) the public

[55] BG-CSD-01

availability of information on projects and government contracts, (ii) the inclusion of stakeholders in the decision-making process through effective consultations with the public, (iii) the provision of environmental and social impact assessments, and (iv) the effectiveness, efficiency and responsiveness of policies.

(i) Although Bulgaria has taken measures to combat corruption, reports on the implementation of Decree 114 on the monitoring and control over the financial conditions of state-owned enterprises showed significant deficiencies for example in providing the required additional performance analysis, lacking consistency in their reports, showing discrepancies between annual reports of the government and companies, and including factual mistakes (Center for the Study of Democracy, 2014). Under its legal requirements driven by EU regulation, the government provides several platforms of information for public access. The Sustainable Energy Development Agency maintains a database of renewable and heating projects.[56] The Agency also provides a contact point to report corruption. Furthermore, Bulgaria's Electric System Operator provides hourly data on the generation of electricity based on source, including data on electricity imported as part of the liberalisation process of Bulgaria's Electricity Market.[57]

Crucially, through the financial support of the EU's PHARE Programme and the Operational Programme Administrative Capacity that is co-funded through the European Social Fund, Bulgaria's Public Procurement Agency (PPA) – itself established as part of the EU accession process in 2004[58] – created a registry of public procurement contracts on its online portal in 2009.[59] Energy enterprises took up a significant share of government contracts in 2010-2012 public procurement processes of about 20% (Center for the Study of Democracy, 2014). While information on general renewable support is transparent due to EU reporting requirements and publicly regulated FiT levels, data on government contracts with conventional power generators remain difficult to access. The registry of

[56] Accessible only in Bulgarian at: http://www.seea.government.bg/bg/
[57] Available at: http://www.eso.bg/?did=124#Начална страница
[58] The Public Procurement Agency is governed by Decree No 56 of the Council of Ministers (prom. SG No 24/23.03.2004).
[59] Available at: http://rop3-app1.aop.bg:7778/portal/page?_pageid=173,1&_dad=portal&_schema=PORTAL

the PPA is counterintuitive to operate, registration necessary to access the advanced search engine, and pieces of information spread out across different access points. As such, there remains no easy access to details, and “the current opaque system of governance of state-owned enterprises is prone to abuses of public funds and serious neglect of the companies’ interest” (Center for the Study of Democracy, 2014, 94).

(ii) Based on the opaque information system, there is also a lack of data on government consultations with stakeholders and the public. According to the Center for the Study of Democracy (2010, 2017, 2014), the government does not provide meaningful consultations on energy projects, despite the importance of an inclusive approach to ensure “that social needs are also taken into consideration in the decision-making process” (Center for the Study of Democracy, 2014, 76). Based on our interviews[60], government miscommunication was indeed a crucial issue in the winter 2013 protest that eventually led to the downfall of the Borisov government following an increase in regulated electricity prices to cover a greater share of the costs of rising renewable generation levels (Velinova *et al.*, 2015). As the former minister of energy in the 2013 interim government, Julian Popov, told us:

> “People were very surprised by the electricity prices because they received bills for forty-five days rather than thirty days, which coincided with the increase of electricity prices by 13%, which was not a lot, considering in the period of two or three years, prices were not increased at all. So the increase was modest but very badly communicated because psychologically when people saw the bill, they saw that it doubled.”[61]

The lack of effective communication between government and stakeholders can also be seen in the early-2012 protests against Chevron’s plan to begin shale-gas exploration in Bulgaria that highlighted “that corporations and government did not consult the people and did not make the slightest attempt to create shared value”(Popov, 2013). The subsequent ban of fracking “was […] a punishment for inappropriate public behaviour by the people in power. And this is exactly what the political parties and powerful corporations failed to see” (Popov, 2013).

[60] BG-GOV-01; BG-CSD-01
[61] BG-GOV-01

(iii) The government is obligated under EU Directives 2003/35/EC (European Commission, 2003) and 2009/31/EC (European Commission, 2009), as well as by Bulgaria's Environmental Protection Act to provide environmental impact assessments (EIAs) on defined projects and developments, as seen for example in the case of the South Stream Gas pipeline (Institute of Energy for South-East Europe, 2014). Based on Annex 1 of the Environmental Protection Act (Government of Bulgaria, 2014) that outlines projects in need of EIAs, renewable projects, such as large-scale wind farms or hydropower plants are not mentioned, while crude oil refineries, thermal power stations, and nuclear power stations are. However, for example, large-scale wind installations can have significant adverse environmental effects (Powlesland, 2009; Zimmerling *et al.*, 2013). Indeed, the Court of Justice of the European Union, ruled in 2016 that the Republic of Bulgaria failed to fulfil *inter alia* its obligations under Article 4(4) of the Birds Directive allowing the implementation of several wind farm projects in the Kaliakra region despite its importance for migratory species (Court of Justice of the European Union, 2016).

(iv) Although the initial design of the country's support scheme was generally effective in generating a fast expansion of renewables capacity, due to its extremely generous tariff scheme far above market prices[62] the system was neither efficient nor responsive as it "did not provide adequate FIT buffers and did not account for market, social and economic risks" (Center for the Study of Democracy, 2014, 71). Crucially, the lack of a clear long-term strategy provides opportunities for interest groups to lobby decision-makers and exert corruptive pressure (Mantcheva *et al.*, 2012, 7). As such, due to the corrupted and mismanaged policy framework for renewables, households currently pay a significantly higher than necessary share of the costs of the renewables transition. In fact, the 2020 targets were set to be achieved steadily over a period of time to incentivise technological and therefore cost advancements in renewable energy sources. A more gradual growth trajectory of renewables would have allowed for costs to be distributed over a longer time, including grid expansion costs. Instead, in the case of Bulgaria, the costs were carried by

[62] BG-CSD-01

the state-owned companies in the first place and now will be transferred to the taxpayers to pay the companies' debt.[63] These additional costs burden economically weaker households significantly more as energy poverty is already a major issue in the country.

Furthermore, the system regulating the preferential prices repeatedly proved inadequate to foresee and respond to market dynamics. The problematic regulatory framework was complemented with a general incapacity and incompetence of administrative bodies. For example, the 2011 ERSA delegated the development of procedures to implement renewables projects to local governments, rather than providing a national framework to simplify processes (Winkel *et al.*, 2011). Municipal administrations, however, lacked the expertise and staff to address these tasks adequately (Mantcheva *et al.*, 2012). As a result, the application of a private person for a rooftop solar installation requires a very similar amount of paperwork as for a developer to apply for the construction a nuclear power station as they are governed by the same legislation.[64]

5.7.2 Availability, Sustainability and Affordability

Bulgaria's renewable energy transition provides a mixed picture in terms of distributive justice. In this sub-section, we determine the energy justice principles in light of (i) overall energy dependence levels, (ii) stability of electricity supply, (iii) sustainability improvements in terms of emissions and energy intensity, and (iv) actual electricity costs and price stability.

(i) Through the expansion of renewable energy capacities, Bulgaria's energy market benefitted from an increasing diversification of its electricity mix. As Table 6 shows, the country's largest renewable energy source, hydropower, increased marginally, while solar, wind and to a minor degree biomass capacity grew significantly (D'Ortigue *et al.*, 2015). As such, due to priority grid access, particularly wind and solar power have pushed the overall renewables share in total electricity generation from 9.37% of in 2006 to over 19.1% in 2015 (Eurostat, 2017a).

[63] BG-CSD-01
[64] BG-WWF-01; BG-GREEN-01

Table 6: Renewable capacity additions, 2006 to 2014, in MW

	2006	2014
Hydropower	2800	3200
Wind	27	690
Solar	0	1030
Biomass	6	52

Source: (D'Ortigue *et al.*, 2015).

Since renewables are a domestic source of energy, their expansion has positive effects on Bulgaria's import dependence. While in 2008, about 52% of energy was imported, this rate dropped to just above 35% in 2015, the fifth lowest score across the EU-28 (Eurostat, 2017a). It is important to note that the EU's energy dependence level considers nuclear energy production as indigenous, ignoring the import of nuclear fuels (Government of Bulgaria, 2008). As the import dependence of feedstock for nuclear power generation – the second largest source for total electricity generation – is 100%, in the past the Government of Bulgaria considered the actual import dependence about 25% higher than the rate provided by Eurostat (Government of Bulgaria, 2011b). As all nuclear (and natural gas) imports originate from Russia, the EU Commission stressed that the lack of more diversified import sources remain a concern (European Commission, 2013).

Furthermore, Bulgaria has so far missed the opportunity to address issues related to the large portion of particularly rural households that continue to heat with wood and uses oil generators as backup electricity sources (Center for the Study of Democracy, 2014). Although solar PV installations could help overcome associated price and pollution (and therefore health) issues, growth in residential installations is sluggish – despite continuing government programmes – primarily due to the bureaucratic procedures necessary to develop solar PV installations. An analyst from the Bulgarian Center for the Study of Democracy also noted that a general scepticism in the population towards government programmes in light of the sense of corruption is preventing a greater interest in residential solar.[65]

[65] BG-CSD-01

(ii) Bulgaria's renewable energy transition further provided upgrades to the electricity grid as important expansions to the transmission network and additional substations were realised in 2012 (Jirous *et al.*, 2011).The split of the public electricity provider, the National Electric Company (NEC), from the system operator as part of the unbundling process was also completed in early 2014 (Energy and Water Regulatory Commission Bulgaria, 2015). Overall, owed to the EU's financial support through the European Bank for Reconstruction and Development in developing the country's infrastructure, power transmission and distribution losses in percent of output have been falling steadily since 2002 from almost 15% to about 8.5% in 2014 (World Bank, 2017a). Nevertheless, the average distribution loss of almost 400 tonnes of oil equivalent, represents the second highest in Central and Eastern European Countries (Center for the Study of Democracy, 2014).

(iii) The growth in renewable electricity generation has lowered the environmental footprint of the country's energy system in terms of emissions. CO_2 emissions in kilo tonnes (kt) have decreased from 52.3 thousand kt in 2007 to just above 39.5 thousand kt in 2013. While CO_2 emissions from solid fuels, ie. coal, as a share of total emissions have effectively remained unchanged at 58%, actual emissions from solid fuels in kt fell from 30.4 thousand kt in 2007 to 23.2 in 2013 (World Bank, 2017b). As a result, total greenhouse gas (GHG) emissions decreased by over 37% in 2012 from 1990 levels (World Bank, 2017b). These developments are reflected in Bulgaria's environmental sustainability score of the World Energy Council that increased steadily over the past years (World Energy Council, 2015). Although energy intensity levels decreased by 39% between 2006 and 2010 (European Commission, 2013), Bulgaria continues to have one of the worst index scores across the EU (Center for the Study of Democracy, 2014). Energy expenditure volatility and intensity stand at 3180% and 855% above average OECD risk levels, and CO_2 per GDP and energy intensity 370% and 289% above average OECD risk levels respectively (Center for the Study of Democracy, 2014).

(iv) Although yearly household incomes have increased steadily since Bulgaria's accession to the EU in 2007, parallel rising electricity prices resulted in an increase of household expenditure on housing, energy, water, and other fuels from 11.5% of total income in 2007 to 14.4% in 2012 (Center for the Study of Democracy, 2014), and 14.3% in 2016 (National Statistical Institute, 2017).[66] Official data estimates that only one-third of the Bulgarian population being able to afford adequate heating in their homes (National Statistical Institute, 2017). Since electricity prices remain state-regulated, there is little volatility in the price developments. However, although in principle all consumers are free to choose their supplier, no actual switching is observed, as through the regulated prices for household consumers, there is no benefit in switching and the retail electricity market remains highly concentrated with eight out of total 24 power retailers taking 92% of the market in 2012 (European Commission, 2014).

5.7.3 Intra- and Intergenerational Justice and Responsibility

In terms of intragenerational equity, the rapid expansion of renewables generally enhanced the access of Bulgaria's population to "minimal energy services which enable them to enjoy a basic minimum of wellbeing" (Sovacool and Dworkin, 2015, 440). However, the increased costs of electricity affect poorer consumers disproportionately more, and the government failed to adequately drive the installation of small-scale renewable installations to replace polluting wood and oil generators. Crucially, it thereby failed to improve the equity of the current energy system as grey markets for poor-quality wood used in heating continue to drive prices down, and undermine regulations to preserve Bulgaria's forest stock and increase the country's environmental footprint (Mantcheva *et al.*, 2012).

Most importantly, the failure to meet fundamental energy justice principles in due process and good governance directly led to the dismantling of Bulgaria's renewable energy transition. While

[66] Bulgaria has one of the highest rate of home-owners in the EU with few outstanding mortgages, meaning for the majority of Bulgarians (over 80%), housing costs are zero, while another 15% of the population lives in reduced fee tenancy agreements (European Commission, 2018). The over 14% expenditure share for housing, water and energy should be considered in this light.

the absence of a supportive regulatory framework for renewables, such as the lack of preferential prices, is not an insurmountable obstacle, the associated financial burden and sense of corruption has undermined public support. Although important progress in terms of sustainability was made through the advance of renewables between 2007 and 2013, financial pressures, and the lack of public backing and external incentives – since the renewable targets are already met – undermine the advance of contemporary sustainability improvements and thereby intergenerational equity. As such, the government is failing to adequately fulfil its responsibility to protect the environment, mitigate climate change and safeguard the rights of access to environmental and energy services. As the government failed to provide a stable investment environment that acknowledged environmental, financial and social factors of the promotion of renewables, hopes rest with the growing competitiveness of renewable technologies. As the former minister of energy in the 2013 interim government, Julian Popov, said: “From now on, the only thing that we need in Bulgaria is a level playing field, through the removal of subsidies for conventional energy”.[67]

5.8 Discussion and Conclusions

Through the application of the energy justice framework, we were able to determine how Bulgaria’s expansion of renewables in light of its 2020 targets led to an improved energy independence and grid infrastructure that ensured a more stable, safe and clean distribution of electricity. At the same time, the analysis highlighted the fundamental shortcomings in due process and good governance that enabled a corrupted and mismanaged regulatory framework. These issues resulted in a disproportionate burdening of current consumers and undermined the sustainability of Bulgaria’s renewable energy transition, and thereby intergenerational equity.

Overall, despite the adverse political and regulatory context, renewable energy transitions have proven their potential to serve as important facilitators of improving energy justice in terms of availability and sustainability of energy systems. They thereby represent a central tool for

[67] BG-GOV-01

governments seeking to address contemporary environmental and climate issues, and provide greater intergenerational equity. However, while renewable energy transitions can improve distributive justice in terms of pollution and access to clean energy, they can potentially aggravate the financial burden of energy to consumers. For renewable energy transitions to therefore advance energy justice as a whole requires a long-term government strategy to enable a responsive policy framework that effectively and efficiently drives the expansion of renewable capacity and thereby protects society from both environmental and financial burdens.

As such, by omission Bulgaria's renewable energy transition affirmed the general assumptions of influential factors shaping renewable energy transitions. The case of Bulgaria's renewables expansion showed how the lack of an effective and dynamic policy design undermines the sustainability of renewable energy transitions. This has been particularly expressed in Bulgaria's weak macroeconomic context, in which large portions of the population struggle with energy poverty, and in times of economic crisis and austerity experience a falling purchasing power. The absence of a bottom-up commitment to sustainability transitions resulted in a regulatory environment driven by external targets without a long-term strategy, and was prone to abuse. Bulgaria's mismanaged policy design had significant financial implications for companies and consumers that further undermined public support in a growing perception of government corruption. The opacity in energy contracts with conventional power plants eased the political decision to focus the blame for rising electricity prices almost exclusively on renewables that followed an EU-induced greater public transparency.[68]

As the result of an abused top-down policy approach, officially achieving the 2020 renewable targets in 2013 resulted in the lack of a political incentive to expand renewables further and led to a cessation of support for commercial renewable projects. The subsequent ending of a supportive renewables policy after the reaching of the 2020 targets has halted the process of improving the sustainability of Bulgaria's energy system and led to the conclusion that the "so-called

[68] BG-CSD-01; BG-WWF-01

energy *transition* in Bulgaria never happened".[69] In effect, due to the regulatory overshoot, the "renewable energy market over-burnt in the early years of its development [..., and] the greediness of some to make fast profit without seeing the whole picture stopped the renewable energy transition after 2012".[70]

In conclusion, Bulgaria's renewable energy transition followed a boom and bust cycle that was marked by a rapid expansion of renewable energy capacity until 2012, and subsequent policy adjustments that halted the development of new projects. Driven by a generous preferential pricing scheme that served the financial interests of some, the fast uptake of renewable capacity was aided by general government incompetence in the design of the regulatory framework. The rapidly accumulating cost of the expansion of renewable electricity and associated grid updates added to a growing financial burden in light of falling energy export levels during the economic crisis. Lacking a domestic commitment for sustainability transitions, the expansion of renewables ended as the external incentive in form of the 2020 targets was reached, and financial pressures mounted.

In terms of energy justice, we identified the general potential of renewables to improve distributive justice in light of the justice principles of availability and sustainability. At the same time, the analysis highlighted the fundamental need for good governance and due process to provide an effective, efficient and responsive policy framework that serves the interest of society. Otherwise, a mismanaged renewable energy transition, as in the case of Bulgaria, can lead to a worsening of the affordability principle by overburdening consumers and resulting in growing energy poverty. As seen in the analysis, such financial pressures undermine the overall sustainability of the transition and thereby endanger intergenerational equity. Our analysis hence affirmed the general assumptions on influential factors for renewable energy transitions. It depicted the societal, economic and political implications of a renewable energy transition that lacked a long-term strategy and support, and an effective and dynamic policy design in a macro-economic context of rising energy poverty and

[69] BG-NEW-01
[70] BG-ACAD-01

decreasing purchasing power during the economic crisis and austerity. Rather than create a system of good governance and due process, Bulgaria's pre-existing dynamics of state capture drove the country's rapid renewable energy growth, and ultimately ended it.

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Chapter 6: Summary, Discussion and Conclusions

6.1 Renewable Energy Transitions, Economic Crisis and Austerity in Europe

In light of the costs associated with renewable energy transitions, the research project has sought to address the question of how renewables fared during these adverse economic and financial conditions of the economic crisis and austerity in Europe. To this end, it followed two key analytical stages.

The first stage, the medium-n analysis (MNA), established an important foundation for the investigation by determining the role of economic development for renewables. Through the use of fuzzy-set Qualitative Comparative Analysis (fsQCA), the MNA depicted that conditions for both low- and high-income contexts explain the expansion of renewables equally well. As the state of economic development did not appear to be the crucial determining factor for expanding renewables, in the second analytical stage of the thesis, the small-n analysis (SNA), sought to identify the particular dynamics that drove or inhibited the expansion of renewables in different contexts of economic development through four case studies. Going beyond their differing economic conditions, the cases showed diverse additional contextual factors that affected their expansion of renewables, such as public and political support, the choice of policy instruments, the political context, and the key actors involved in policy. A different focus was used within each case, reflecting the context specific factors shaping renewables development. In the following section a wider discussion of the surrounding politics of renewable energy transitions during the economic crisis and austerity across is provided within which the findings from the cases are contextualised.

Chapter Three provided a comparative analysis between Germany, a high income Eurozone member with a history of climate action and renewables, yet also one of austerity, and the UK, which similarly is considered a climate pioneer and advocate of austerity. The case study depicted how differing macroeconomic trends and political environments affected the responses to renewable policies during the economic crisis and austerity. An important basis for the argument was the fundamentally different politics of renewables in the two countries. In Germany, anti-nuclear movements, a social market economy system, and a preference for boosting domestic renewable industry pioneers resulted in a favourable market for developing renewables under a premium tariff system that provided long-term securities for investors. However, the criticisms of Germany's *Energiewende* have become louder in recent years, due to the increased system costs the FiT incurred. These costs had become particularly visible as wholesale electricity prices fell during the economic crisis, and increasingly burdened households and non-energy intensive industries due to the exemption of energy intensive ones. That these significant added costs – as shown in the Chapter – did not have a more severe effect on the public support of renewables relates back to the political environment, in which the *Energiewende* has enjoyed popular support. As Germany's economy continued largely untouched through the crisis, the repercussions of austerity were not experienced as strongly as elsewhere – not least since major austerity policies had already been implemented in the previous decades.

The UK showed a slightly different picture, with a worsening financial situation through rising deficit and debt levels, while its renewable energy transition had from the start faced pointed criticisms. Public popularity was limited by factors of aesthetics and costs, as the UK benefitted from cheaper (natural gas) or less visible (nuclear energy) low(er)-carbon power sources. At the same time, renewables support was integrated into a largely liberalised electricity market under a neo-liberal government philosophy that has dominated UK politics for decades. The surprising expansion of government spending in a Keynesian move to counteract a worsening recession during the economic crisis, while detrimental for the deficit, proved short lived and the UK's renewable energy policy fell under a strict umbrella of financial constraint through, *inter alia*, the Levy Control Framework. Additional cuts to climate programs, and premature cancellation of the Renewables Obligation reflected an austere government policy and were in line with public sentiments, where the cost and potential aesthetic impacts of renewables proved the focus of a successful mobilisation against them.

Chapter Four addressed Portugal's significant challenge of adhering to the Troika's austerity requirements, while reaching its obligations under the 2020 targets. The country's long history of overspending and indebtedness was paralleled with a growing support for renewable energy. Traditionally powered by hydropower, public support for wind and solar was also the result of government policies that favoured the creation of industry clusters around renewables. As the public was also largely shielded from rising electricity prices at the cost of a growing tariff debt, Portugal's society and political parties continued to support a green future for the country, visible through its 2030 Green Growth Strategy. Nevertheless, forced by the requirements of the Troika to reduce debt, the government decided to discontinue FiTs for several renewable sources that effectively ended new respective projects from being contracted. The case depicted a complicated interplay of various interest groups and actors, pursuing different goals, with the Portuguese authorities seeking to fulfil each obligation. Interviews suggested that there were also divisions at EU level, with different positions emerging within the relevant DGs (DG ENER and DG ECOFIN), as financial limits threatened the expansion of renewables, and vice versa. In the end, a crucial reason for the lack of new contracted projects was the bottleneck between the Iberian peninsula and France, which to be opened up, will require extensive bi-lateral talks between the involved parties.

Finally, Chapter Five examined a very different political environment, in which renewables were considered a business opportunity under imposed targets by the EU rather than a means to mitigate climate change and improve a country's economy and energy security – as visible in the previous cases. Bulgaria went largely unscathed through the financial and economic crisis and through a brief intermezzo of austerity policies regained a balanced budget. The country's generous renewable support even benefitted from the worsening situation elsewhere in Europe and attracted a multitude of investors. This supporting scheme for renewables, however, was built on corruption and resulted in a mismanaged and poorly coordinated expansion of renewables that eventually led to the full cessation of support by the government. This boom and bust cycle that renewables experienced was *inter alia* the result of the notion of a top down European imposition through the

2020 targets, and the failure of the government to create a shared value of renewables among the people. In fact, even the still existing financial support for residential small-scale renewable installations has not led to a uptick in demand, due to the lack of interest, or downright scepticism of society. As such the public experience of a badly communicated and implemented renewable expansion that involved the first increase in electricity prices in years, turned out to be more detrimental for Bulgarian renewable energy than favourable, and effectively prohibited a meaningful transition in Bulgaria's electricity generation.

Through the case analysis, the thesis highlighted the different obstacles and opportunities that affected renewable energy transitions during the economic crisis and austerity, as well as the political environments that resulted in and from them. It should be noted that due to the restricted number of in-depth interviews and the related limits in the representation of varying views, certain biases may be present in the thesis. Although the project eschewed a rigorous cross-comparative research design of the cases in favour of a more mixed analytical approach as is typically pursued in a thesis by papers, the findings nevertheless depicted some general perspectives on renewable energy transitions during the recent financial and economic crisis, which are outlined in the following.

6.1.1 The effects of austerity and mounting financial concerns

Two central aims of the thesis have been the identification of the role of economic development (ii) and austerity measures (iii) in European renewable energy transitions. The MNA initially established an ambivalent picture and thereby hinted at the importance of other factors, potentially in combination with economic development, as being influential for renewable energy transitions. At the same time, austerity has taken many different forms in various economic and political climates. While each of the analysed countries implemented austerity measures, the role of renewable energy transitions differed in each case. Unsurprisingly, the biggest effect of austerity could be observed in the two countries that struggled under a growing government debt, namely Portugal and the UK. Countries with a more positive government deficit and debt trend, such as Germany and Bulgaria, nevertheless faced increasing financial concerns over their renewables promotion. Overall, the four analyses depicted how renewable energy transitions were affected by increasing financial concerns during the economic crisis that led to more or less severe policy changes depending on the case.

The Portuguese case (Chapter Four) depicted how the cost of renewables can directly lead to severe repercussions under a policy of austerity. The country's pioneering role in the European wind sector received a significant blow when the Troika pushed the Portuguese government to address its increasing tariff debt. This debt resulted from the unwillingness of the government to fully transfer the rising cost of its energy system onto consumers, particularly in light of the country's economic downturn. Obligated to curtail the accumulation of further debt, Portugal hence decided to halt all financial support for large-scale wind farms and small-scale hydropower. The government expects to reach the 2020 targets through already contracted projects and the refurbishing of existing installations.

In the UK (Chapter Three), austerity did not lead to a similarly drastic end in the support for renewables. Nevertheless, the country adjusted its renewable policy to achieve its ambitious 2020 targets in light of its worsening fiscal environment. These policy adjustments sought to achieve a supportive policy framework for renewables, while also restricting costs for consumers and the government. The cuts to programs considered too expensive or inessential to reaching the 2020 targets, and the introduction of the Levy Control Framework are examples of this. In the end, austerity led to several policy changes that however threaten to undermine the overall investment climate and thereby possibly endanger the goals set out under the 2020 Strategy.

Carried by its export sector and the resulting account surplus, the German economy quickly emerged from its self-imposed austerity programme, with a balanced government budget and falling debt levels. At the same time, its *Energiewende* remained a global example of how to effectively promote the expansion of renewables, while cost concerns questioned its efficiency. Indeed, this successful expansion in terms of added capacity had led to a serious increase in electricity prices, particularly for private consumers, as during the crisis the government had put far-reaching exemptions for the energy-intensive industrial sector into place. Austerity had only limited effects on the renewables sector, although it led to initial budgetary adjustments at the ministerial level and to a restructuring of Germany's subsidy system. The cost of the country's increasingly renewable energy system, however, led to the decision to abandon its premium-Feed-in tariffs (FiT) in favour of a tender/auction system in 2014 (effective since 2017).

Finally, in Bulgaria, austerity had been embedded in governmental fiscal policy since its emergence from communist rule, and therefore within months the country was able to return to healthy deficit levels after an initial stimulus package. As such, the country's renewable market remained largely unaffected by austerity and the financial crisis. The explosion in renewables growth, aided by a corrupted and mismanaged regulatory framework, however, led to very different, cost-related issues that, once the 2020 targets had been achieved, resulted in the abandonment of any governmental support for large-scale renewable installations.

Crucially, both the MNA and the multifaceted four case studies of the SNA depicted the complex and context-dependent role of political and economic factors for renewable energy transitions. Each part of the thesis reaffirmed that economic considerations, such as costs, affect the politics surrounding the expansion of renewable energy, for example in the choice in policy instruments. In times of economic crisis and austerity, these financial concerns played an important role in each of the cases, and were seen to either be directly linked to austerity and economic recession (Portugal, UK), or more as a result of the cost of domestic renewables policies and potentially as an indirect consequence of the effects of the economic and debt crises (Bulgaria, Germany).

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6.1.2 The Europe 2020 targets in the face of multiple challenges

The other two aims of the thesis focused on improving the general understanding of important drivers and inhibitors for renewables (i), and on enhancing our knowledge of the factors important for successful renewable energy transitions (iv). As such, the MNA depicted a generally good progress in renewable energy transitions across the EU-28. The results of the fsQCA also depicted that economic pre-conditions do not pre-determin the expansion of renewables. Although not tested for, the fact that all members of the EU, and therefore all four case studies, are obliged to reach their respective 2020 targets appears to constitute a sufficiently important driving force to overcome potential obstacles in terms of means.

Germany and the UK both met their 2013 NREAP trajectory goals, however, both still need to significantly expand their renewables electricity share to reach their respective 2020 targets. In 2015, Germany had reached a renewable electricity share of 30.7%, with a 2020 target of 38.6%, while the UK had reached 22.4% with a target of 31% (Eurostat, 2017a; EUFORES, 2015). As such, each country has been visibly seeking to balance the growing cost of their renewable support policies with the need to provide a steady renewables growth environment. The UK has had the more difficult task in both respects as its fiscal situation has suffered more from the economic crisis, and its energy policy approach never focused especially on the development of renewables. With its ambitious targets, the country began to provide greater incentives for renewables that have been successful in driving renewable energy since 2009, yet also increased the cost of the UK's energy system. As such, the policy changes in 2014 and 2015 under the auspices of austerity could have been significantly more severe in the absence of binding renewables targets; or rather, the shift towards the increasing support of renewables is unlikely to have been implemented in the first place.

The effect that a lack of incentive in form of targets can have on renewable energy transitions in times of economic and financial hardship was visible in Bulgaria and in Portugal. Although both countries, have their own 2020 targets to reach, in 2013 Bulgaria had already exceeded the renewable share in final energy that it planned to reach by 2020. With a renewable electricity share of 19.1% in 2015 the country also has almost reached its 20.6% renewable electricity share as per its unbinding NREAP trajectory (Eurostat, 2017; EUFORES, 2015). The country subsequently saw no reason to continue its support for large-scale renewable energy projects, particularly in light of mounting cost issues. In Portugal, the 2013 moratorium on financial support for onshore wind farms and small-scale hydropower projects was similarly argued on the basis that the 2020 targets could be reached without the need for further major capacity additions. Reaching a renewable electricity share of 52.6% in 2015, the country is indeed in close range to its 2020 goals of 55.6% (Eurostat, 2017a; EUFORES, 2015).

The fact that that the two countries that still require significant renewable capacity additions in order to reach their targets maintained their supporting policy instruments, while countries that already met, or are about to meet their targets abandoned them, speaks volumes about the significance of the 2020 targets. In this sense, the thesis, however, also stressed the limitations of targets to implicate long-term strategies that are crucial for the sustainability of renewable energy transitions. Indeed, the case of Bulgaria showcased the potential repercussions of the lack of a bottom-up and thereby long-term commitment to renewables that allowed for state capture to abuse the regulatory framework. Having communicated its renewable energy transitions as merely fulfilling the requirements of Brussels, the government failed to establish public support for renewables domestically. Since renewables were almost exclusively blamed for rising electricity prices, after the 2020 targets were reached Bulgaria's energy transition was publically unsupportable. Although the mismanaged renewable energy transition in Bulgaria naturally cannot be attributed to the 2020 targets, it shows the limited degree to which targets can safeguard and maintain support for renewables.

At the same time it is important to note that also a commitment to climate action alone was insufficient to guarantee a continued strong support of renewables. Germany, Portugal and the UK are countries with a strong public and governmental support for sustainability and each in their way have pioneered European climate action. However, caught in their respective economic and financial circumstances, each country was forced to acknowledge the importance of its economic and financial stability vis-à-vis its sustainability ambitions. The presence of a bottom-up support of renewable energy and climate action, however, can be an important factor in preventing a more significant effect of economic and financial pressures on renewables. Although Portugal's government implemented a major shift in its renewables policy, also enabled through the imminent reaching of its 2020 targets, the country has maintained its public and political commitment to sustainability transitions. This unwavering support is visible in its green growth strategy for 2030 and the central purpose of its policy adjustments to improve the financial sustainability of its renewable energy transition. A key difference from the Bulgarian case to the Portuguese one, therefore, lies in the valuation of renewables to the government and public. In Bulgaria, renewables were considered as a business opportunity by some, a way of illegal enrichment by others, and as a demand from the EU by most. That meant, once costs were too high, and targets already reached, there was no push for a continuation of renewables, since the underlying goals of the renewable targets (lower emissions, climate change, etc.) were not internalised.

Indeed, Portugal's financial struggles in its energy system highlighted a fourth important factor for successful renewable energy transitions: the infrastructural and market conditions across Europe. The absence of sufficient transboundary interconnectors between the Iberian Peninsula and the resulting inability to export excess renewable electricity undermined the economic viability of both Portugal's and Spain's renewable energy transitions. The lack of integration of the EU's energy system is thereby also insufficient to address the challenges associated with large-scale renewables generation, such as intermittency. At the same time, the case of Bulgaria depicted a country's reluctance to adopt the EU's energy packages and increasingly integrate its electricity market. This fear stems from subsequent price increases, as Bulgaria currently has the lowest electricity prices across the EU.

Through these multiple facets of the analyses, the thesis highlighted the complex interplay of factors that drove and hindered renewable energy transitions in Europe during times of economic crisis and austerity. Obstacles include the direct financial constrains under a system of fiscal consolidation and the economic concerns of rising energy costs. At the same time, international targets represented an essential driving force, while the analysis stressed the additional need for a long-term strategy that is carried by an unwavering public and governmental commitment to improve the sustainability of Europe's energy system. The renewable energy transitions at a national level nevertheless need to be supported by an increasingly integrated, transboundary European energy system that can help overcome both technical and economic challenges associated with renewables.

6.1.3 An uncertain future

Renewable energy transitions face many uncertainties in current times of crisis. While the 2015 Paris Agreement raised hopes for increasing global unity in combatting climate change, the simultaneous resurgence of populism across Europe and North-America, post-truth politics, and the looming Brexit – the decision of the UK to leave the EU – instead threaten a growing international fragmentation. Collective action is central to the fight against climate change, and as the thesis has shown; international targets play an important role in the commitment of countries towards the promotion of renewables. As such, the financial and economic implications of Brexit, paired with a potential loss of EU energy targets are likely to affect the UK's energy market. However, also the EU's energy and climate policies will have to balance the loss of an important actor (Fischer and Geden, 2016). Political uncertainty also takes a hold of other European countries where debates are increasingly shaped by the growing power of post-truth populism. The environmental crisis is therefore challenged by a new 'popular' crisis that currently receives larger public attention and could have detrimental effects for the efficacy of contemporary climate action.

This new crisis emerges as the effects of the economic crisis and austerity have yet to completely play out. Indeed, the full effects of the renewables policy adjustments of the past years are not clear, as we do not know what their implications for the growth trajectory of renewables will be. Important questions remain: How will Germany's ending of its FiT scheme affect its renewables market? Is the UK's Contract for Difference able to generate the necessary capacity additions to meet the countries 2020 targets, and will it even matter after Brexit? Will Portugal be able to reach its 2020 targets despite its reduced financial support, and how will its renewables market develop afterwards in light of the limited export opportunities for electricity? Will Bulgaria's renewables market recover from its current set-back?

Although these contemporary challenges for renewables in Europe have been highlighted in times of economic crisis and austerity, and many of the current policy changes have been implemented as a result of economic and financial struggles, they stress more fundamental issues with renewable energy transitions relating to their costs (visible across all cases) and to structural obstacles on the European energy market (depicted particularly by the Portuguese case). In this sense, and on a more positive note, costs for renewables have been falling steadily over the past years with some onshore wind projects being already competitive with fossil fuels at market prices. Also solar and more recently offshore wind technologies are experiencing falling project costs (IRENA, 2017a, 2017b). As such, renewables are perceived to have reached a 'critical mass' that enables the increasing cost-focus of policies over potentially greater investment certainty. These current shifts in renewable energy policy instruments towards tender and auction systems are thereby an important step to get closer to the actual, lower market price of renewables. Bringing greater cost efficiency to renewables is crucial for the sustainability of energy transitions. The achieving of a more sustainable energy system cannot take place at an unreasonable economic cost through the overburdening of consumers and industries. This reality has been made very clear by the cases of this thesis, where the importance of economic competitiveness and danger of energy poverty were raised repeatedly.

With price trends shifting in favour of renewables, the abolishment of energy subsidies, including for fossil fuels should be more rigorously discussed. While a level playing field is unlikely to be established in the near future, the energy market is already undergoing change. This change is in response to the new dynamics resulting from a greater share of renewables in electricity generation, the increasingly decentralised electricity grid and the (slow) advent of electro-mobility. While major utility companies are adjusting their business structures and strategies – such as the split of conventional power sources from German E.ON into a new independent company (E.ON, 2016) – the Juncker-Commission has rightly been pushing for advancing the creation of the EU's Energy Union. The Clean Energy Package that is expected to be passed in 2018 will provide important new measures, for example in driving demand-flexibility through smart grids (European Commission, 2017b). There are, therefore, some positive signals beyond the unpredictability of current political trends and the challenges associated with the creation of a more integrated European energy market.

6.2 Conclusions

Energy plays a crucial role for human development, and at the same time is a major contributor to anthropogenic climate change. The transition of the energy system towards the use of clean and renewable energy sources is associated with significant investments and therefore costs. As the economic crisis and subsequent austerity measures refocused governments' attention towards wider economic issues and fiscal consolidation, this thesis' research question has been:

> *How have European renewable energy transitions fared during the economic crisis and austerity?*

Set out to i) improve our general understanding of the driving forces and obstacles of European renewable energy transitions, and to identify the effects of ii) economic development and iii) austerity for renewables, the thesis employed a nested-n approach, which included a medium-n analysis (MNA) of all 28 EU member-states, and a small-n analysis (SNA) of four selected case studies. It thereby iv) enhanced our knowledge of factors influential for successful renewable energy transitions, by *inter alia* highlighting the importance of a comprehensive regulatory framework, an integrated European energy system, and a long term strategy.

The thesis answered the research question by identifying general political, economic, financial and renewable energy trends in the EU, before establishing the different ways in which renewable energy transitions have developed in times of austerity and under the particular economic, political and financial concerns of the respective case study. Despite the varying manifestations of austerity and its effects, drawing from the findings of the SNA, the analysis highlighted a general cost-focused readjustment of renewable energy policies across countries. Indeed, the economic crisis and austerity have arguably pushed financial issues to the front of contemporary sustainability transitions. The thesis thereby depicted how renewable energy policies that drove capacity additions in the past – in some cases almost regardless of the burden they caused for consumers (Germany) or public finances (Portugal) – have now been revisited and adjusted to make European renewable energy transitions more financially sustainable, i.e. cheaper.

As such, the analysis depicted how renewable energy transitions are shaped by the economic situation and policy-approach of its government. The increasingly cost-focused reorientation of renewable policies under an austere government, however, also highlighted the importance of international targets as upholders of collective climate action. Indeed, the thesis' findings that renewable energy transitions in EU member-states have been driven both because and despite of economic development and income levels, is seen to be largely attributable to the Europe 2020 targets. The thesis thereby fulfilled an important aim by identifying a crucial driver of European renewable energy transitions, while also showing the role of the economy and public finances.

The thesis thereby also stressed the more fundamental regulatory and structural issues of Europe's renewable energy transitions. The partly austerity-induced focus on the cost of current renewable energy transitions is in fact a direct response to the economic and societal effects of mismanaged or overly generous policy instruments (Germany, Bulgaria). At the same time, fundamental structural adjustments improving the integration of the European energy market are important in achieving lower energy costs. As such, while the environmental crisis continues, the economic and financial one has proven to be both challenge and opportunity. As the measures taken in times of austerity may indeed have an overall positive impact on the financial sustainability of renewable energy transitions, further changes are needed in order to achieve a more integrated, low carbon, and low cost energy transition.

As the implications for its efficacy of an increasingly cost-concerned European renewable energy transition are yet to be seen, Europe is already facing a new crisis in form of a resurging national populism that threatens the collective action and internationalism that is required to effectively mitigate climate change. Any failure to build on current policy adjustments and address contemporary structural issues and market obstacles for renewables could be to the detriment of present climate action and future societies.

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Appendices

Appendix A: Chapter 2, Aggregate Raw Data for outcome and conditions for fsQCA

Country	Renewable Electricity Share Difference, 2008-13	Renewable Electricity Share 2020 Target as per NREAP, in percent	Renewable Electricity Share of 2020 target achieved in 2013, in percent	Average GDP per capita, 2008-2013, in USD	Average real GDP growth, 2008-2013, in percent	Average government debt to GDP ratio, 2008-2013, in percent	Average government deficit to GDP ratio, 2008-2013, in percent
Belgium	8.8	20.9	64.1	46,292.09	0.63	101.41	-3.56
Bulgaria	8.9	20.6	91.7	7,370.85	0.87	16.91	-1.97
Czech Republic	8.7	13.5	103.0	20,389.43	0.51	39.06	-3.11
Denmark	22.6	51.9	93.4	60,121.03	-0.29	42.54	-1.07
Germany	13.1	38.6	73.1	44,647.82	0.84	75.44	-1.21
Estonia	12.5	17.6	83.0	17,387.17	-0.04	7.69	-0.46
Ireland	11.5	42.5	53.4	52,756.02	0.21	92.53	-11.89
Greece	12.3	39.8	55.0	25,750.72	-4.14	153.11	-10.31
Spain	14.1	40	94.5	31,174.18	-0.91	71.44	-8.23
France	3.9	27	67.8	42,501.93	0.40	84.49	-5.01
Croatia	11.5	39	116.2	14,056.28	-1.57	64.50	-5.56
Italy	16.8	26	128.5	36,737.46	-1.30	118.80	-3.50
Cyprus	7.1	16	46.3	30,417.49	-1.04	73.01	-4.96
Latvia	12.4	59.8	85.5	14,016.48	-0.87	38.13	-4.06
Lithuania	8.8	21	65.2	14,240.18	0.81	33.76	-4.91
Luxembourg	2.3	11.8	50.0	109,480.96	1.39	19.79	0.76
Hungary	2	10.9	67.0	13,723.85	0.09	77.47	-3.63
Malta	3.3	13.8	23.9	21,087.68	2.41	67.31	-3.06
Netherlands	2.5	37	27.0	52,249.45	0.16	62.03	-3.31
Austria	4.8	70.6	99.2	49,550.63	0.54	79.93	-2.84
Poland	8	19.13	64.8	13,298.73	3.11	52.09	-4.90
Portugal	18	55.3	94.2	22,562.12	-0.99	106.90	-7.13
Romania	13.6	42.62	97.8	9,144.26	1.26	30.81	-4.86
Slovenia	3.9	39.3	86.3	24,311.68	-0.50	49.61	-6.24
Slovakia	6	24	95.8	17,653.62	1.93	44.23	-4.50
Finland	4.1	33	95.2	49,202.77	-0.70	48.24	-1.41
Sweden	9.7	63	100.5	55,705.90	0.87	39.07	-0.39
United Kingdom	12.3	31	57.4	41,648.94	0.69	76.50	-7.50

Source: (Eurostat, 2017; The World Bank, 2016)

Appendix B: Chapter 2, R-Script, Calibration and Analysis

```
library(QCApro)

#Poet Calibration
RESPdata<- read.csv("~/qca/rescsv")
View(RESPdata)
summary(RESPdata)
RESP <- calibrate(RESPdata$RESP, type = "fuzzy", thresholds = c(0, 7, 14))

RESAdata<- read.csv("~/qca/resa.csv")
View(RESAdata)
summary(RESAdata)
RESA <- calibrate(RESAdata$RESA, type = "fuzzy", thresholds = c(0, 50, 100))

#Conditions Calibration
GDPPCdata<- read.csv("~/qca/gdppc.csv")
View(GDPPCdata)
summary(GDPPCdata)
GDPPC <- calibrate(GDPPCdata$GDPPC, type = "fuzzy", thresholds = c(0, 33000, 66000))

GDPGdata<- read.csv("~/qca/gdpg.csv")
View(GDPGdata)
summary(GDPGdata)
GDPG <- calibrate(GDPGdata$GDPG, type = "fuzzy", thresholds = c(-2, 0, 2))

DEFdata<- read.csv("~/qca/def.csv")
View(DEFdata)
summary(DEFdata)
DEF <- calibrate(DEFdata$DEF, type = "fuzzy", thresholds = c(0,-3, -6))

DEBdata<- read.csv("~/qca/deb.csv")
View(DEBdata)
summary(DEBdata)
DEB <- calibrate(DEBdata$DEB, type = "fuzzy", thresholds = c(0, 60, 120))

#Analysis
data <- read.csv("~/qca/data.csv")
View(data)
conditions <- c("EURO", "GDPPC","GDPG", "DEF", "DEB")

tt1 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = 1.0,)
tt1
ana1 <- eQMC(tt1, details = TRUE)
ana1

tt2 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .99,)
tt2
ana2 <-eQMC(tt2, details = TRUE)
ana2
```

```
tt3 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .98,)
tt3
ana3 <- eQMC(tt3, details = TRUE)
ana3

tt4 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .97,)
tt4
ana4 <- eQMC(tt4, details = TRUE)
ana4

tt5 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .96,)
tt5
ana5 <- eQMC(tt5, details = TRUE)
ana5

tt6 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .95,)
tt6
ana6 <- eQMC(tt6, details = TRUE)
ana6

tt7 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .94,)
tt7
ana7 <- eQMC(tt7, details = TRUE)
ana7

tt8 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .93,)
tt8
ana8 <- eQMC(tt8, details = TRUE)
ana8

tt9 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .92,)
tt9
ana9 <- eQMC(tt9, details = TRUE)
ana9

tt10 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .91,)
tt10
ana10 <- eQMC(tt10, details = TRUE)
ana10

tt11 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .9,)
tt11
ana11 <- eQMC(tt11, details = TRUE)
ana11


tt12 <- truthTable(data, outcome = "POET", exo.facs = conditions, incl.cut1 = .89,)
tt12
ana12 <- eQMC(tt12, details = TRUE)
ana12
```

Appendix C: Chapter 4 & 5, Project Information Sheet, Interview

THE UNIVERSITY *of York*

PROJECT INFORMATION SHEET

Evaluating renewable energy transitions during the financial and economic crisis in Europe

Thank you for your interest in participating in this research study.

The project is funded by the Leverhulme Trust and seeks to identify the extent to which renewable energy transitions in Europe have been affected by the financial and economic crisis.

The conducted expert interviews are aimed at gaining greater insight into the trends and developments inside the renewable energy sector in [*COUNTRY*] during the economic crisis.

Participating in the interviews is completely voluntary. You will be given a copy of this information sheet to keep, and be asked to sign a consent form. You can withdraw your participation and comments at any time (prior to the publication of any research) and without giving a reason.

During the interview, I will be asking questions on your thoughts and experiences regarding the relationship between renewable energy transitions and the economic and financial crisis. The interview is a one-time interview and should not last longer than an hour. All data provided will be stored securely and all information will be handled confidentially and anonymity will be ensured, if desired. The information you provide will be used to guide and inform research publications on this topic. I would be more than happy to share the results of the research project, should it be of interest.

This research has been given ethical approval by the University of York Environment Department, UK.

For any further questions, please feel free to contact me, Jan-Justus Andreas, at ja973@york.ac.uk.

Thank you for taking the time to read this information sheet, and I hope you will be willing to participate in this research project.

Appendix D: Chapter 4 & 5, Form of Consent

THE UNIVERSITY of York

Interview Consent Form

<u>Evaluating renewable energy transitions during the financial and economic crisis in Europe</u>

Jan-Justus Andreas
PhD Researcher
Environment Department, Room 313
University of York, Y01 5NG, UK

Please indicate

1. I confirm that I have read and understood the information sheet for the above study

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason

3. I agree to take part in the above study

4. I agree to the interview being audio recorded

5. I agree to the use of anonymised quotes in publications

____________________	_____________	__________________
Name of Participant	Date	Signature
Jan-Justus Andreas	_____________	__________________
Name of Researcher	Date	Signature

Appendix E: Chapter 4 & 5, Indicative Questions, Interview

THE UNIVERSITY of York

Indicative Questions on renewable energy transitions in the EU during the financial and economic crisis

In your view, has the financial and economic crisis, as well as austerity measures across European economies affected their renewable energy transition?

If yes, in what ways has this been visible?

> Has there been a change in the government's support for renewable energy? If so, what was the rationale for such changes?
>
> Has there been a shift in the type or extent of renewable policy instruments?
>
> In your view do state positions reflect longstanding preferences or has their position shifted? If so why?
>
> Have general budget cuts affected the implementation or operation of renewable programs?
>
> What role have energy costs played?
>
> Has there been a significant change in investment levels in the renewable sector over the course of the crisis?
>
> Overall, are you aware of any differences between the states in their renewable energy policies that may have been fuelled by the crisis? For example, are some states more reluctant to (continue to) incentivise the expansion of renewable energy?

If not, why not?

> In your experience, what factors *did* impact (change in) renewable energy policy?

Appendix F: Chapter 4, Sample Letter Portugal, Interview

Querido(a) Senhor(a),

Espero que esteja bem.

Apologies for continuing in English, however, my Portuguese is very limited.

My name is Justus Andreas, and I am a doctoral researcher at the University of York in the UK, working on the effects of the economic crisis on renewable energy transitions in the European Union.

I am writing you to inquire whether you would be willing to talk to me about Portugal's renewable energy expansion during the economic crisis. Any insights and observations on relevant developments and processes would be of great help, and much appreciated.

The interviews are part of my doctoral thesis. Since I am currently based in York, the interview could take place via phone or Skype. If there are any concerns about confidentiality, I will be very happy to discuss how these can be accommodated.

The project is described in more detail in the attached document and I also included a set of indicative questions.

Thank you for considering my request, and I am very much looking forward to your responses.

Muito obgriado!

Atenciosamente,
Justus Andreas

Appendix G: Chapter 5, Sample Letter Bulgaria, Interview

Dear XX,
I hope this finds you well.

I am a doctoral researcher at the University of York (United Kingdom) currently investigating renewable energy transitions under the European Union's 2020 Strategy in Bulgaria in front of the backdrop of the economic crisis and the European Debt Crisis.

I am hoping to interview you as a member of XX to gain a better insight into the drivers of the renewable energy transition in Bulgaria, and how the economic and financial situation in the country may have impacted recent developments in Bulgaria's energy transition. The interview will last no more than 45 minutes. Considering your activities in Bulgaria, the insight and perspective that XX can provide would be of considerable value, and I would be very grateful if you could find the time in your undoubtedly busy schedule to talk to me.

Since I am currently based in York, the interview could take place via phone or Skype. If there are any concerns about confidentiality, I will be very happy to discuss how these can be accommodated.

The project is described in more detail in the attached document and I also included a set of indicative questions.

Thank you for considering my request, and I look forward to hearing from you.

Yours sincerely,
Justus Andreas

Appendix H: Chapter 4 & 5, Interviews and Reference Codes, Portugal and Bulgaria

Portugal

Name	Affiliation	Reference
Ricardo Vieira	WWF Portugal	PT-P03-WWF
Leono Pires	DG ECFIN	EU-P01-ECFIN
Pedro Guedes de Campo	DG ECFIN	EU-P02-ECFIN
Joao Heredia	DG ENER	EU-P03-ENER
Carlos Zorrinho	European Parliament	EU-P04-PARL
Giorgio Corbetta	European Wind Energy Association (EWEA)	EU-P05-EWEA
Susana Serodio	Portuguese Renewables Association (APREN)	PT-P01-APREN
Jose Medeiros Pinto	Portuguese Renewables Association (APREN)	PT-P02-APREN

Bulgaria

Name	Affiliation	Reference
Anonymised	European Bank for Reconstruction and Development (EBRD)	no citation
Georgi Stefanov	WWF	BG-WWF-01
Martin Vladimirov	Centre for the Study of Democracy (CSD)	BG-CSD-01
Julian Popov	Former Interim Minister Energy	BG-GOV-01
Anton Ivanov	Bulgarian Energy and Mining Forum	BG-BEMF-01
Atanas Georgiev	Assoc. Professor, Sofia University	BG-ACAD-01
Ilin Stanev	Editor, Capital Newspaper	BG-NEW-01
Petko Kovachek	Bulgarian Green Party	BG-GREEN-01